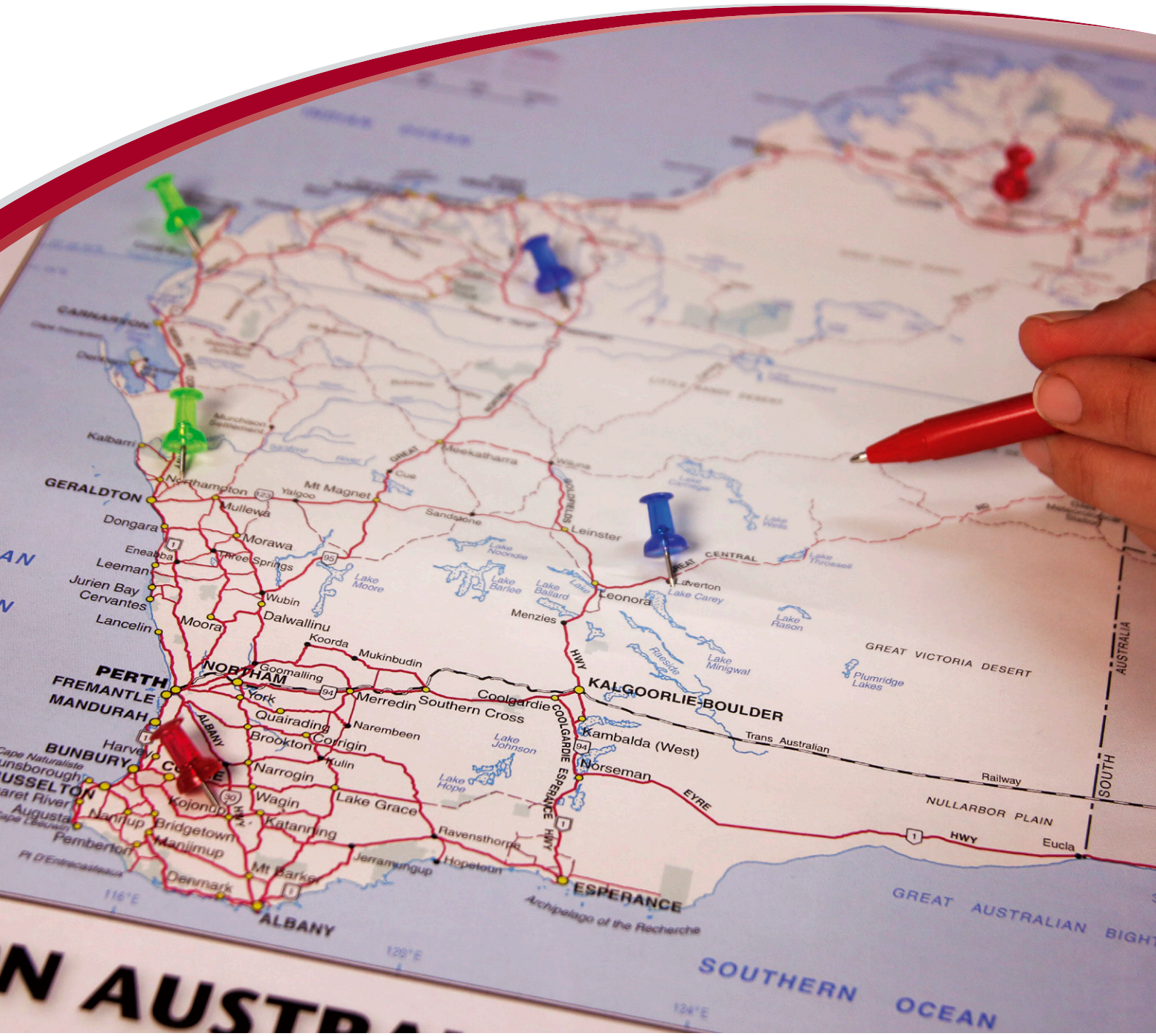
Government of **Western Australia**
Department of **Health**

WAPHA
WA Primary Health Alliance

Lessons of Location:

Potentially Preventable Hospitalisation Hotspots in Western Australia 2017



better health ▪ better care ▪ better value

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Foreword

This publication summarises the purpose, methodology and findings of a collaborative project between the WA health system and the WA Primary Health Alliance (WAPHA). Both are focused on improving the health of vulnerable people in identified areas of need through the development of targeted, locally tailored solutions that specifically address health inequalities. Western Australia (WA) is a geographically diverse state and one-size-fits-all solutions will not work. It is therefore important that we apply a co-design and collaborative approach to addressing the health needs in our regions. The WA health system/WAPHA Hotspots Report objectives are to identify:

- Current evidence about geographic health inequalities.
- Places with very poor, but potentially preventable, health outcomes through targeted primary healthcare interventions.
- Where place-based approaches can be effective where location is a direct risk factor.
- Opportunities to better target health and broader services to those most in need.

Using hospital admissions data sets that were available for WA, this report identifies places in WA that have had potentially preventable hospitalisation (PPH) rates that are markedly higher than the state average over four, three-year rolling periods. This is indicative of variations in the health status of the underlying populations.

'Hotspots' are small areas with relatively high risk or incidence of a particular health problem and are being used to target and tailor public health interventions around the world [1]. The methodology that has been used for identifying these hotspot areas of WA, with persistent but reducible problems, has referenced the Grattan Institute's *Perils of Place* report methodology [1].

Perils of Place provided a methodology for finding PPH hotspots as local indicators of health inequality and found hotspots in Queensland and Victoria. The WA Department of Health and WAPHA based their methodology on *Perils of Place*, but altered it to suit the WA data. Instead, to reduce the effect of random variation on the rates observed due to sparse admissions in some areas, rolling periods and three-year aggregations of data were used.

The strategic visions of the WA health system and WAPHA are well aligned. The WA health system's vision is to deliver a safe, high-quality, sustainable health system and WAPHA's is to improve health equity in WA. Both organisations maintain a strong commitment to being responsive to the needs of local communities – and to establishing the evidence base needed to support integrated, place-based health care across the state.

The WA health system is WA's provider of public health services. With WA spanning more than 2.5 million square kilometres, it is the largest area in the world covered by a single health authority. The WA health system's strategic priorities are focused on a continuum of care to support and guide health care through integrated service delivery, from prevention and health promotion, early intervention, primary care through to diagnosis, treatment, rehabilitation and palliation.

Ensuring people in WA receive safe, high-quality and accessible health services underpin these strategic priorities. This includes delivering health services that are patient centred, based on evidence and within a culture of continuous improvement.

WAPHA is the organisation that oversees the strategic commissioning functions of the three Western Australian Primary Health Networks (PHNs): Perth North, Perth South and Country WA.

PHNs were established by the Federal Government in 2015 to make health care services more efficient and effective and to improve coordination of care within their regions based on "an understanding of the health care needs of their communities through analysis and planning".

The WA PHNs undertake ongoing needs assessments to identify needs and set priorities for their regions. When setting local priorities, PHNs consider which health problems are preventable, which interventions are most likely to be effective, and how they will target chosen interventions to those most in need. This is done with a focus on place-based targeting.

Improvements made to primary care service delivery enable early diagnoses, appropriate treatments and continuum of care in a community setting, avoiding the need for patients to be admitted to hospital. A reduction in the hospitalisation of patients for conditions that can be cared for appropriately in the community, frees resources in the hospital sector to address other issues.

Context

Potentially preventable hospitalisations (PPHs) accounted for approximately 6% of all hospitalisations from 2010-14 and cost $352.6 million per year [2].

Reductions in PPHs are important to WAPHA because this is one of the headline indicators for PHNs outlined by the Commonwealth Department of Health. A reduction in PPHs would also aid the WA Department of Health by reducing unnecessary pressure upon the state's health system.

The Australian healthcare system is experiencing increasing demand due to various factors such as the changing profile of the population (ageing, longevity) and the shifting burden of disease from acute to chronic and complex conditions [3]. There is also international recognition of the need to manage demand for high-cost acute health care services more effectively, and to achieve a better balance between acute and primary health care services.

The Australian hospital sector has long had a focus on preventing hospital admissions as a way of reducing demand. Preventing hospital admissions is also a priority for the primary care sector, as there is evidence that health outcomes can be improved when care is provided in a coordinated, systematic approach with a strong and effective primary care component [4, 5].

What is a potentially preventable hospitalisation?

A potentially preventable hospitalisation (PPH) is an admission to hospital which may be prevented through the provision of appropriate individualised preventative health interventions and early disease management usually delivered in primary care and community settings by general practitioners (GPs), medical specialists, dentists, nurses or allied health professionals.

Based on the literature, PPHs can be classified into the following 3 groups of conditions:

1. Vaccine-preventable conditions. These include hospitalisation for conditions such as influenza, bacterial pneumonia, tetanus and others.
2. Chronic and complex conditions. These include conditions such as asthma, chronic obstructive pulmonary disease (COPD), diabetes, congestive heart failure (CHF) etc.
3. Acute medical conditions. These include dehydration, gastroenteritis, cellulitis, urinary tract infection etc.

Hospitalisations for conditions such as measles and tetanus can be prevented by primary health care through vaccination. Hospitalisations for pharyngitis can be prevented through timely treatment with antibiotics via primary health care and hospitalisations for diabetes complications can be prevented through appropriate, long-term management of diabetes by primary and community health practitioners. This definition excludes conditions that are preventable predominately through population health interventions, such as those for clean air and water. [6]

What is a hotspot?

A hotspot is an area that shows a rate of hospitalisation (specifically inpatient admission as opposed to Emergency Department attendance) of at least 1.5 times the state average for any one of the particular conditions outlined in the Australian Institute of Health and Welfare (AIHW) PPH definition above. In lay person's terms, a hospitalisation rate 1.5 times the state average makes the area 'hot'. The ratio used to compare the rate of the area to the state average is known as a Standardised Rate Ratio or SRR. These rates are adjusted for age which means the effect of population age differences between areas and the State were eliminated – allowing comparisons between the populations [7].

The rates are measured via separations; these are where episodes of care, treatment and/or accommodation of an admitted patient cease [8]. The SRR is the ratio of observed separations in an area, to expected separations derived when the state population rate is applied to the area's population. This ratio can be expressed as a percentage simply by multiplying by 100. A ratio of 1 means that the area's rate is the same as the state, and a value of 2 indicates the area's rate is twice that of the state. A rate ratio of 0.5 indicates that the rate in an area is half that of the state rate.

In this study the geographical areas used to assess hotspots were the Australian Bureau of Statistic's SA2s. SA2s are general-purpose medium-sized geographical areas which aim to represent a community that interacts together socially and economically. SA2s generally have a population range of 3 000 to 25 000 persons, and have an average population of about 10 000 persons [9].

Standardised Rate Ratio

In order to appropriately discard random variation in hospitalisation rates year upon year, the area must show persistent heat. To qualify as a hotspot, the SA2 had to have SRRs for three continuous periods greater than or equal to 1.5 (meaning 50% higher than the state rate), for a particular PPH category. Therefore, when an area is persistently 'hot' we know the area persistently has higher than average hospitalisation rates for a particular condition. Hence, an intervention may be warranted.

Hotspots can provide an indication of which areas are currently, or have been experiencing sustained inequity in terms of primary or community based care, the absence of which leads residents to access hospital care instead. The preference of the individual to choose hospital based care over primary or community based care also contributes to hospital admission rates. Even if adequate primary and community care is available, individuals may choose not to seek it out and therefore later require care in the hospital system. PPH conditions have usually developed over time. In this context: current admissions may also be a reflection of historical lack or avoidance of primary or community based care in an area.

The analysis in this report is based on inpatient admissions from 2010/11 to 2015/16, in four rolling periods of three years each, 2010/11 to 2012/13, 2011/12 to 2013/14, 2012/13 to 2014/15 and 2013/14 to 2015/16.

Please note that a high SRR does not necessarily correspond to a higher number of admissions. Multiple factors can contribute to a high SRR, including the average rate of hospitalisation for that particular condition for the state and the size of the local population. Hotspots with the same SRR for the same PPH condition may have quite different volumes of admissions, due to different underlying population sizes. Similarly, if an area qualifies as a hotspot for two different conditions with the same size SRR they may have a greater volume of separations for one condition over the other due to the state average of admissions for the first condition being much higher than that of the second.

What is remoteness classification?

Remoteness classifications are categorised according to the Australian Statistical Geography Standard – Remoteness Area (ASGS-RA) 2011 [10]. The classification defines locations in terms of remoteness, such as physical distance of a location from the nearest Urban Centre. The codes increase in number as distance from Urban Cities increases i.e.

Code 1	Major cities of Australia
Code 2	Inner regional Australia
Code 3	Outer regional Australia
Code 4	Remote Australia
Code 5	Very remote Australia

What is socioeconomic index for areas score?

A socioeconomic index for areas (SEIFA) disadvantage decile is a number from 1 to 10 associated with each SA2 area, which indicates the level of socioeconomic disadvantage of an area [11]. If it is within the 10% of most disadvantaged areas in the state, it is associated with SEIFA decile 1. If it is in the 10% of least disadvantaged areas in the state, it is allocated the number 10 [12].

Building the evidence for place based intervention

Place shapes population health via social determinants of health and health service proximity; whereby outcomes and opportunities are shaped by place. The conditions in which people live (‘social determinants’) are linked to place and health differences. Where the role of place in shaping people’s health and opportunity is well-established, there is only limited evidence for what works in reducing place-based health inequalities[1].

To build the limited evidence of what works in reducing place-based health problems, the state government is working with Primary Health Networks (PHNs) to identify these needs by place. The WA PHNs have also included place based prioritisation as part of their Needs Assessments for commissioning services within each of the states PHN regions.

The WA Hotspots report is a collaborative first step in building the evidence base to identify the small areas of WA where health inequalities are entrenched and, without intervention, are likely to endure.

Results

The major categories of chronic, acute and vaccine-preventable PPHs were analysed. A separate analysis of the top 10 conditions ordered by volume, are tabled below:

1. chronic obstructive pulmonary disease (COPD)

2. diabetes complications
3. convulsions and epilepsy
4. congestive cardiac failure (CCF)
5. cellulitis
6. angina
7. iron deficiency anaemia
8. dental conditions
9. ear nose throat (ENT) infections
10. urinary tract infections (UTIs)

Hotspots maps

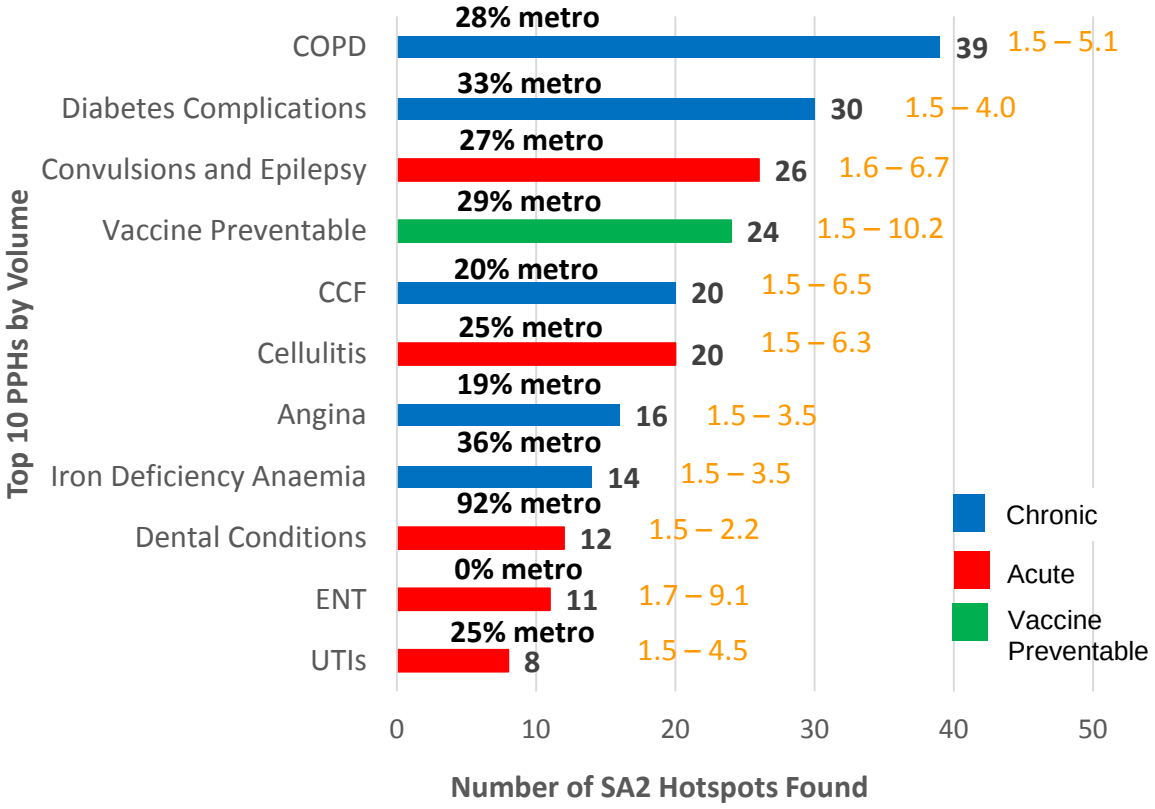
This report includes fifteen hotspot maps showing metropolitan and country WA hotspots for each of the 10 leading conditions by volume and the major categories. These are heat gradient maps, so the greater the SRR, the 'hotter' or more deeply shaded red the hotspot area will appear.

1. Number of hot conditions – total number of PPH conditions (0 to 11) that each SA2 qualifies as a hotspot for. These are the 10 highest by volume as well as vaccine-preventable.
2. Hotspots for acute conditions – the 10 acute conditions examined together.
3. Cellulitis hotspots.
4. Dental condition hotspots.
5. ENT infection hotspots.
6. UTI hotspots.
7. Convulsions and epilepsy hotspots.
8. Hotspots for chronic conditions – the 10 chronic conditions examined together.
9. COPD hotspots.
10. Diabetes complications hotspots.
11. CCF hotspots.
12. Angina hotspots.
13. Iron deficiency anaemia hotspots.
14. Hotspots for vaccine-preventable conditions – the two vaccine-preventable conditions examined together.
15. Hotspots overall – all 22 PPH conditions examined together.

Points on top 10 potentially preventable hotspots conditions by volume

The top ten PPH conditions by volume and vaccine-preventable PPHs are listed in the Figure 1 below in descending order of the number of hotspots found for each condition. Above each bar is the percent of those hotspots located in the metropolitan area. Generally, around 70% of hotspots for each condition occur in country WA. The range of SRRs found by type of PPH is depicted in orange on the right (Figure 1).

Figure 1. Number of hotspots per potentially preventable hotspots condition (top 10 potentially preventable hotspots and vaccine-preventable)

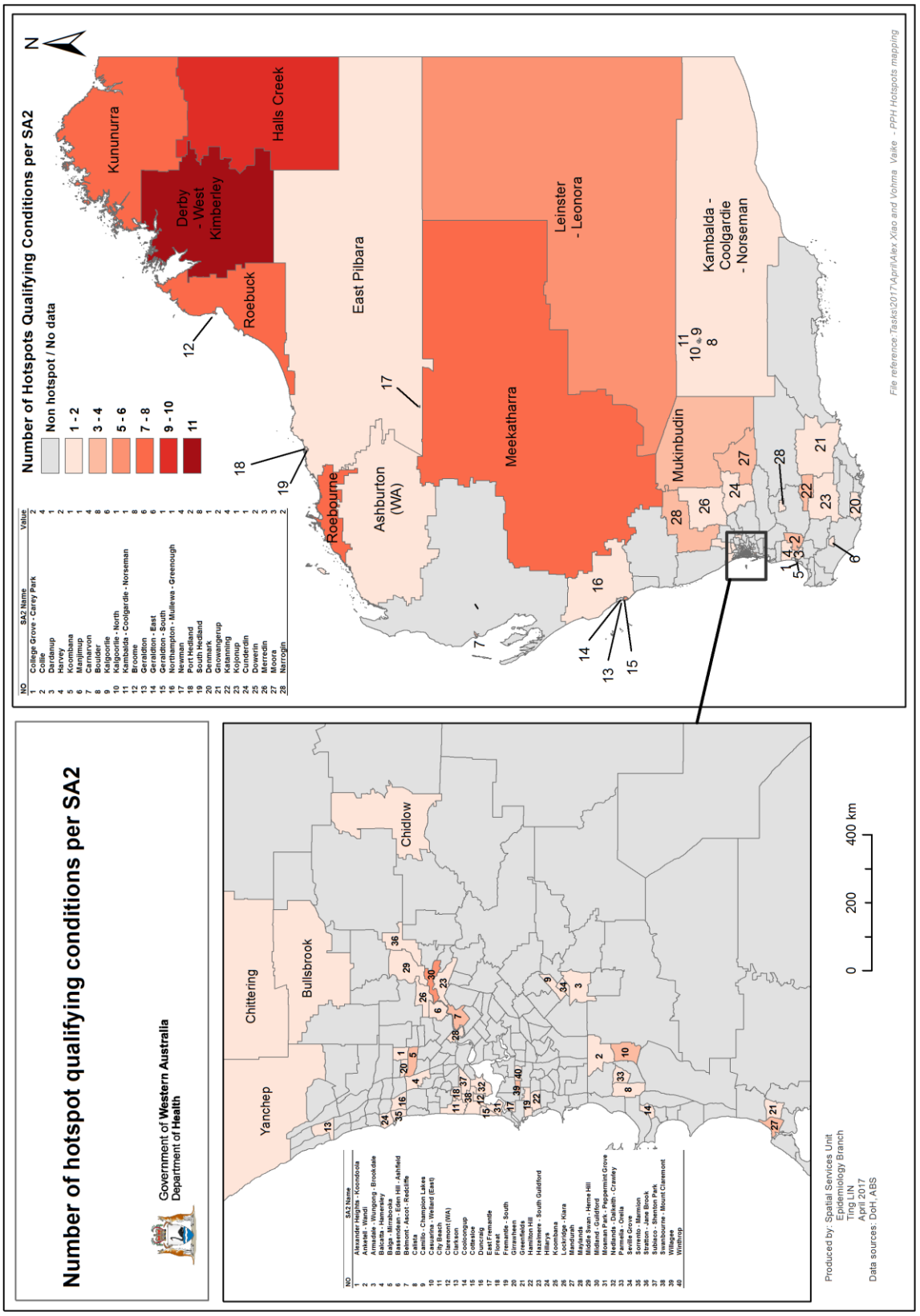


All 11 hotspots for ENT infections were located in the country WA (inner regional, outer regional, remote or very remote Australia). The smallest proportion of Aboriginal people in an ENT infection hotspot location was 6%, which is twice the state average. The greatest volumes of admissions for the condition were from Derby - West Kimberley and Halls Creek with an average of 91 and 62 admissions respectively for the 2013/14 to 2015/16 period.

The greatest inequity as indicated by the magnitude of SRRs was found for vaccine-preventable conditions in the Kimberley with 10.2 times the rate of hospitalisation for the state in Derby - West Kimberley. The second greatest inequity was for ENT infections with an SRR of 9.1 in Halls Creek.

Total number of PPH conditions (0 to 11) that each SA2 qualifies as a hotspot for are presented in Map 1.

MAP 1


Number of hotspot qualifying conditions per SA2
Government of Western Australia
Department of Health
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
0
200
400 km
Chittering
Bullsbrook
Chidlow
Yanchep
Number of Hotspots Qualifying Conditions per SA2
Non hotspot / No data
1 - 2
3 - 4
5 - 6
7 - 8
9 - 10
11
Kununurra
Derby - West Kimberley
Halls Creek
Roebuck
East Pilbara
Roebourne
Ashburton (WA)
Meekatharra
Leinster - Leonora
Kambalda - Coolgardie - Norseman
Mukinbudin
File reference:Tasks\2017\April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

COPD was the PPH condition with the most hotspots, with 39 hotspots identified. 27 of these were from the metropolitan area and 12 from country WA.

On average, between 2013/14 and 2015/16, there were 33 admissions per year per hotspot area for COPD, with the highest number coming from Geraldton (70 admissions per year on average).

The greatest inequity for COPD over the 2013/14 to 2015/16 period was seen in South Hedland, with an age standardised rate of hospitalisation 5.2 times the state average. From 2010/11 through to 2015/16, hospitalisation rates for South Hedland remained above five times the state average. For the same period, the greatest number of admissions came from Geraldton, followed by Armadale-Wungong-Brookdale, Greenfields and Midland, with 70, 68, 67 and 65 average admissions per annum respectively.

Throughout WA admissions for dental conditions are relatively common among PPHs. For all areas named as hotspots, dental conditions had the highest number of PPHs of all of the top 10 conditions by volume examined separately, 1600 more than for UTIs and 2600 more than COPD, for the 2013/14 to 2015/16 period.

There were 12 hotspot locations only for dental condition PPHs. These were predominantly coastal, north metropolitan locations and included the whole of the Cottesloe-Claremont area and parts of the Joondalup area as well as Subiaco-Shenton Park. The only country WA dental hotspot was Derby-West Kimberley.

On average, between 2013/14 and 2015/16, there were 72 admissions per year per hotspot area for dental conditions with the highest number coming from Nedlands – Dalkeith – Crawley (118 admissions per year on average).

There was an overwhelming association between dental condition hotspots and private health insurance. Examining the 11 metropolitan hotspots only, the proportion of admissions that were funded by private health insurance was on average 92%, as opposed to 70% for non-hotspots. Age also played a factor in determining hotspots for dental conditions. There were significantly more adults and older adults admitted in hotspots than non-hotspots.

Certain sub-categories of dental conditions were associated with hotspots more so than non-hotspot areas. These were: loss of teeth due to accident, extraction or local periodontal disease, disorders of teeth and supporting structures unspecified, pathological fracture of tooth and dental caries.

There were 30 hotspots for diabetes complications and 26 for convulsions and epilepsy scattered throughout the state. These were associated with socioeconomic disadvantage. All but one had SEIFA disadvantage deciles of 6 and below, being in the 60% of most disadvantaged areas in the state.

The number of admissions for UTIs was the second highest overall with, on average, 86 admissions per SA2 over the 2013/14 to 2015/16 period. Only dental conditions had more (on average 107 admissions per SA2). It had the least number of hotspots, eight, with five of those in the Kimberley.

There were 20 hotspots each for CCF and cellulitis and about 5000 admissions for both over the 2013/14 to 2015/16 period.

There were 18 hotspots for angina and 14 for iron deficiency anaemia each with about 4000 admissions for the 2013/14 to 2015/16 period.

The maps for the conditions described above are now presented in descending order of total volume of admissions:

1. hotspots for acute conditions – the 10 acute conditions examined together
2. cellulitis hotspots
3. dental condition hotspots
4. ENT infection hotspots
5. UTI hotspots
6. convulsions and epilepsy hotspots
7. hotspots for chronic conditions – the 10 chronic conditions examined together
8. COPD hotspots
9. diabetes complications hotspots
10. CCF hotspots
11. angina hotspots
12. iron deficiency anaemia hotspots
13. hotspots for vaccine-preventable conditions – the 2 vaccine-preventable conditions examined together
14. hotspots overall – All 22 PPH conditions examined together

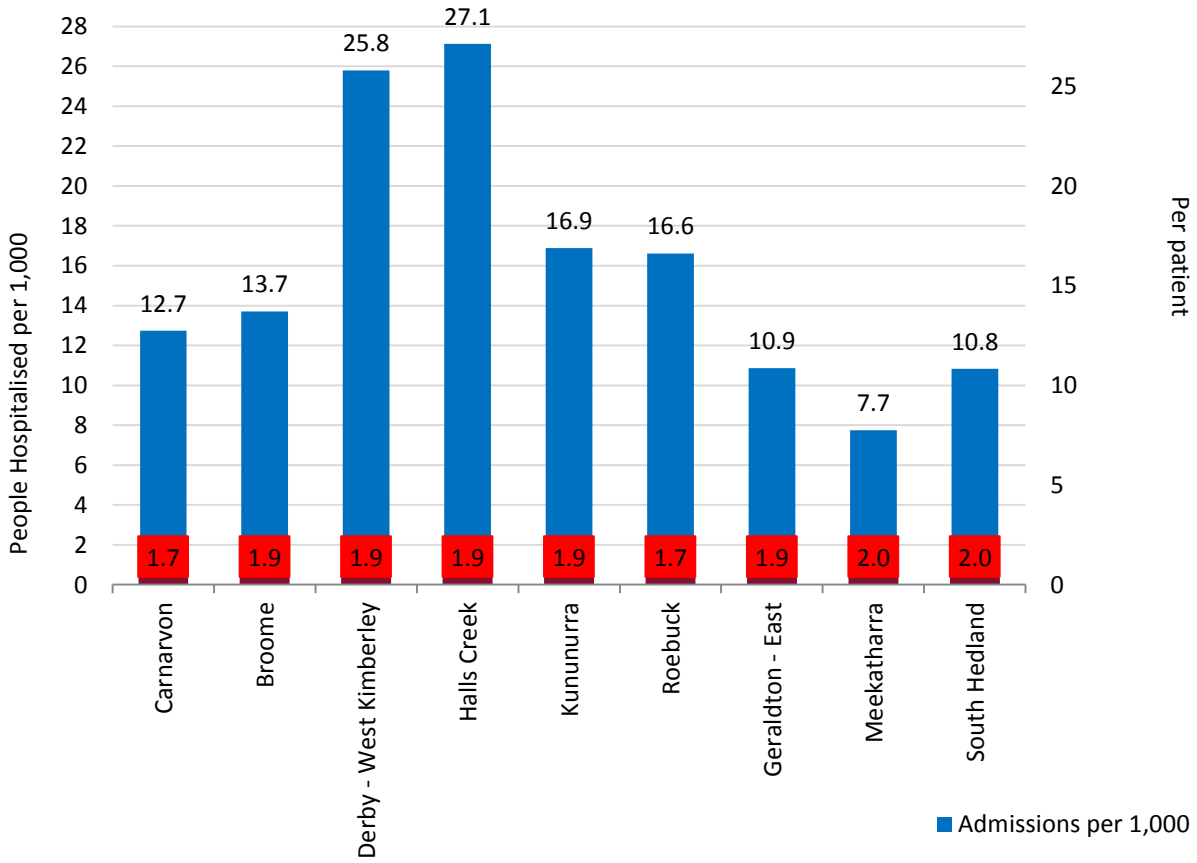
Comparison with acute conditions (10 conditions analysed together)

There were only 9 hotspots for acute PPH conditions examined together. All of these occurred in country WA. The whole of the Kimberley region qualified as a hotspot with Derby – West Kimberley and Halls Creek standing out with age-standardised rates of admission for these conditions more than four times the state average.

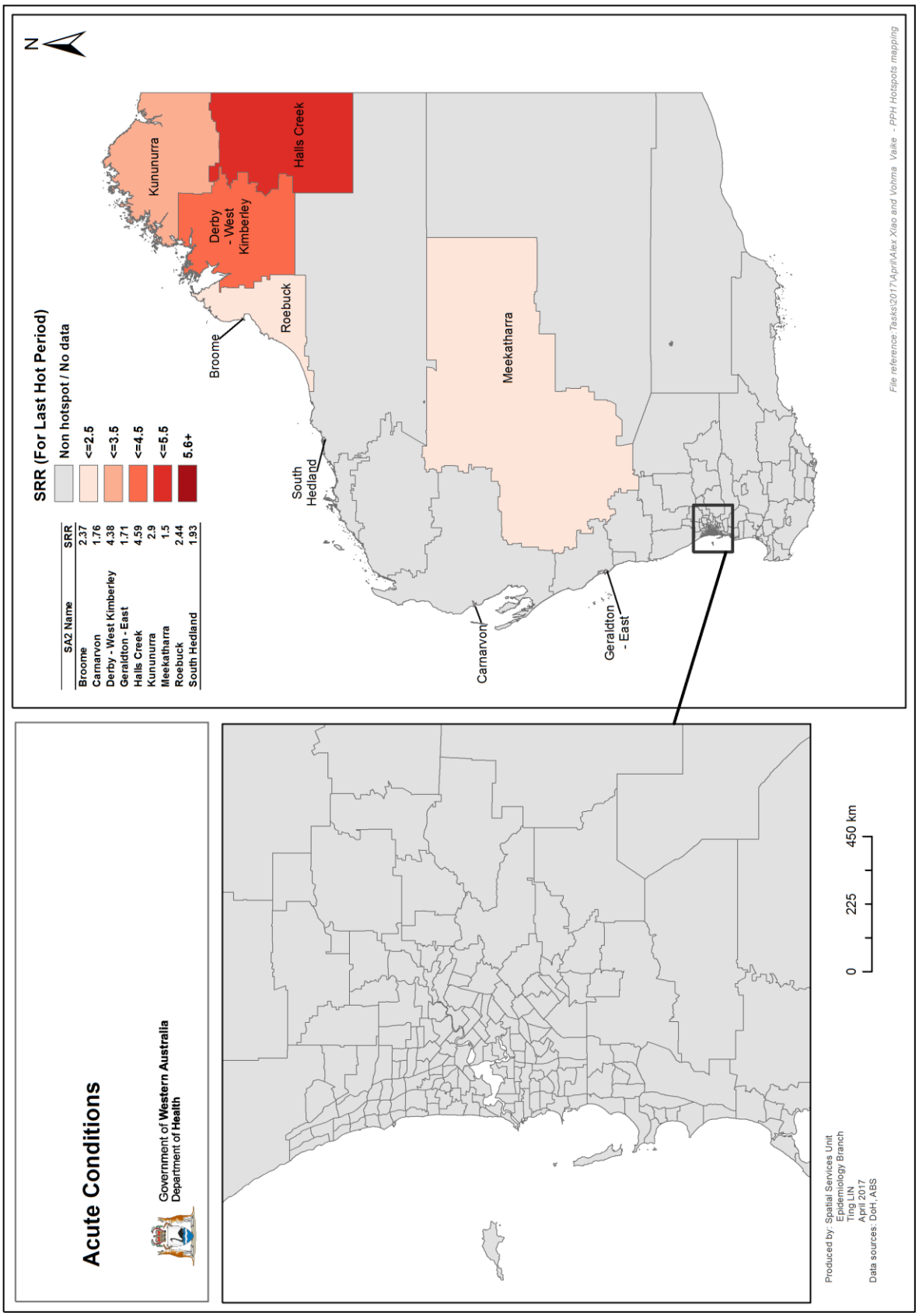
Derby – West Kimberley and Halls Creek in the Kimberley region had the greatest rate of admissions per 1000 of their population at 25.8 and 27.1 respectively (Figure 2).

Generally, the number of people admitted per 1000 is much greater for areas that qualify as hotspots for acute conditions than for chronic condition hotspots (15.8 admissions compared to 6.7 admissions on average). However, the number of admissions per patient is lower for acute conditions, (1.9 admissions compared to 2.6 admissions on average). Thus, acute condition hotspots lend themselves more toward reducing the total number of people being admitted altogether.

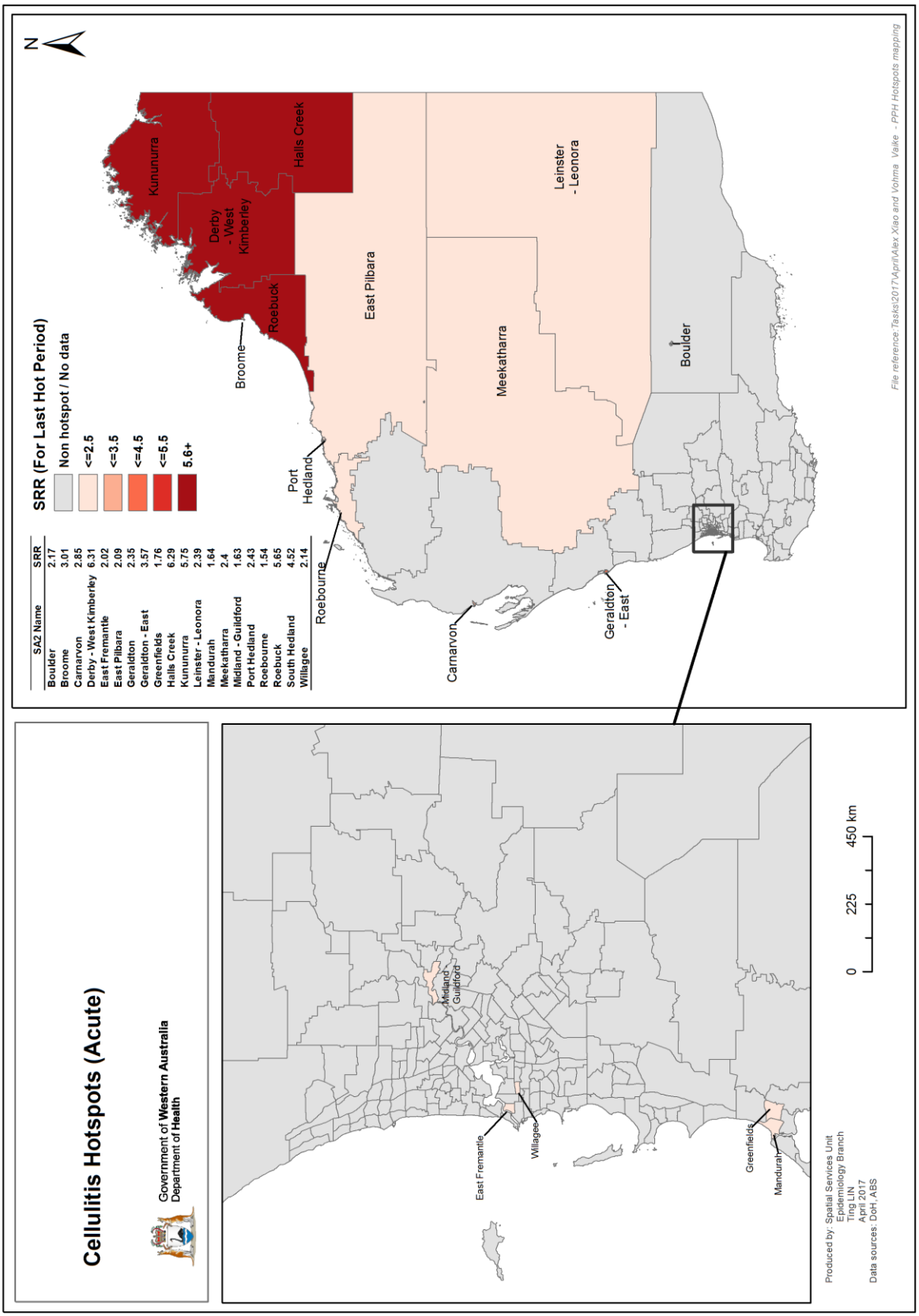
Figure 2. Acute condition hotspots – admissions per 1000 population and hospitalisations per patient



MAP 2


Acute Conditions
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Broome 2.37
Carnarvon 1.76
Derby - West Kimberley 4.38
Geraldton - East 1.71
Halls Creek 4.59
Kununurra 2.9
Meekatharra 1.5
Roebuck 2.44
South Hedland 1.93
Kununurra
Halls Creek
Derby - West Kimberley
Roebuck
Broome
South Hedland
Meekatharra
Carnarvon
Geraldton - East
N
0 225 450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference: Tasks\2017\April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

MAP 3


Cellulitis Hotspots (Acute)
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Boulder 2.17
Broome 3.01
Carnarvon 2.85
Derby - West Kimberley 6.31
East Fremantle 2.02
East Pilbara 2.09
Geraldton 2.35
Geraldton - East 3.57
Greenfields 1.76
Halls Creek 6.29
Kununurra 5.75
Leinster - Leonora 2.39
Mandurah 1.64
Meekatharra 2.4
Midland - Guildford 1.63
Port Hedland 2.43
Roebourne 1.54
Roebuck 5.65
South Hedland 4.52
Willagee 2.14
Kununurra
Halls Creek
Derby - West Kimberley
Roebuck
Broome
East Pilbara
Meekatharra
Leinster - Leonora
Boulder
Port Hedland
Roebourne
Carnarvon
Geraldton - East
N
0 225 450 km
Midland - Guildford
East Fremantle
Willagee
Greenfields
Mandurah
Produced by: Spatial Services Unit
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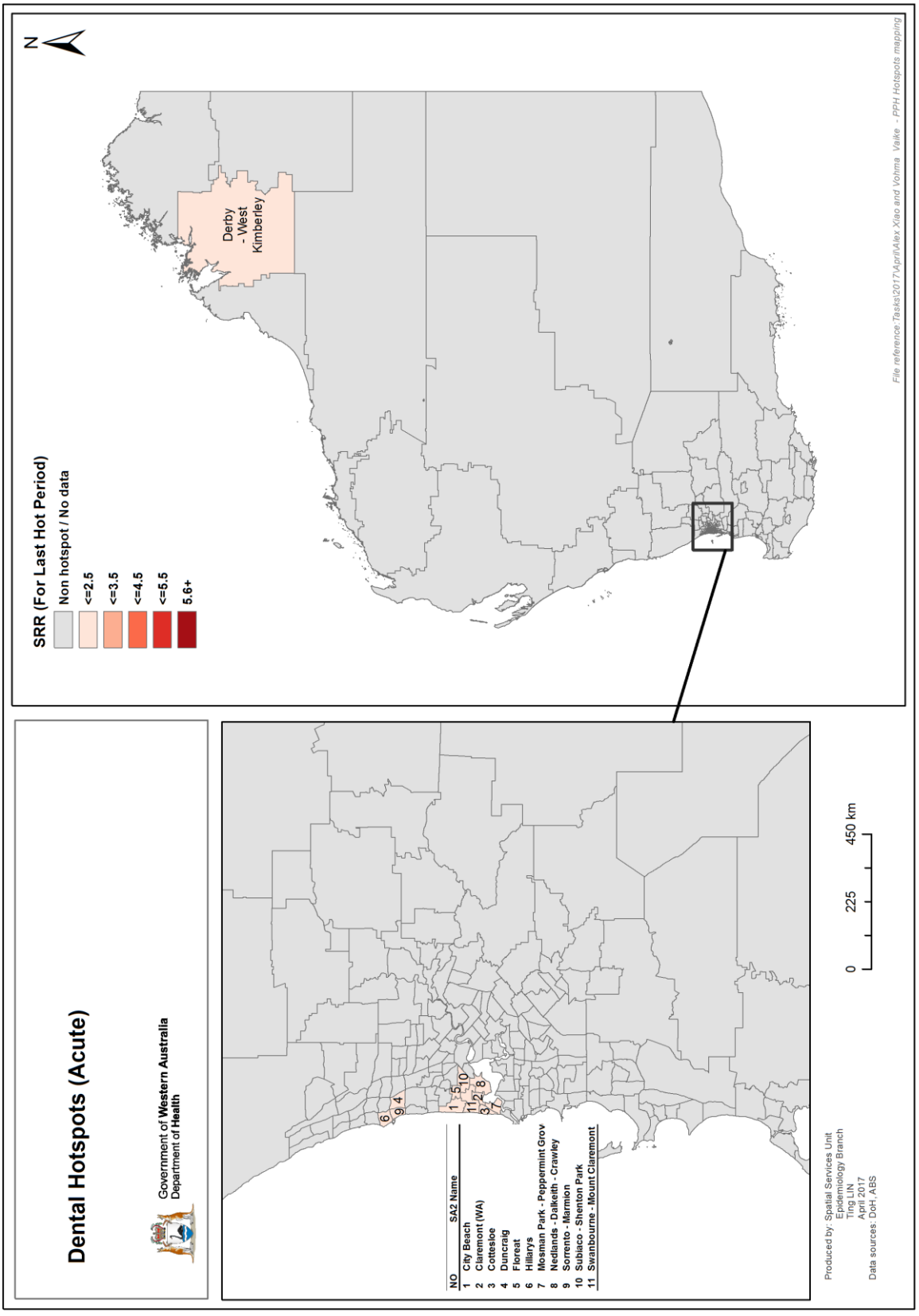
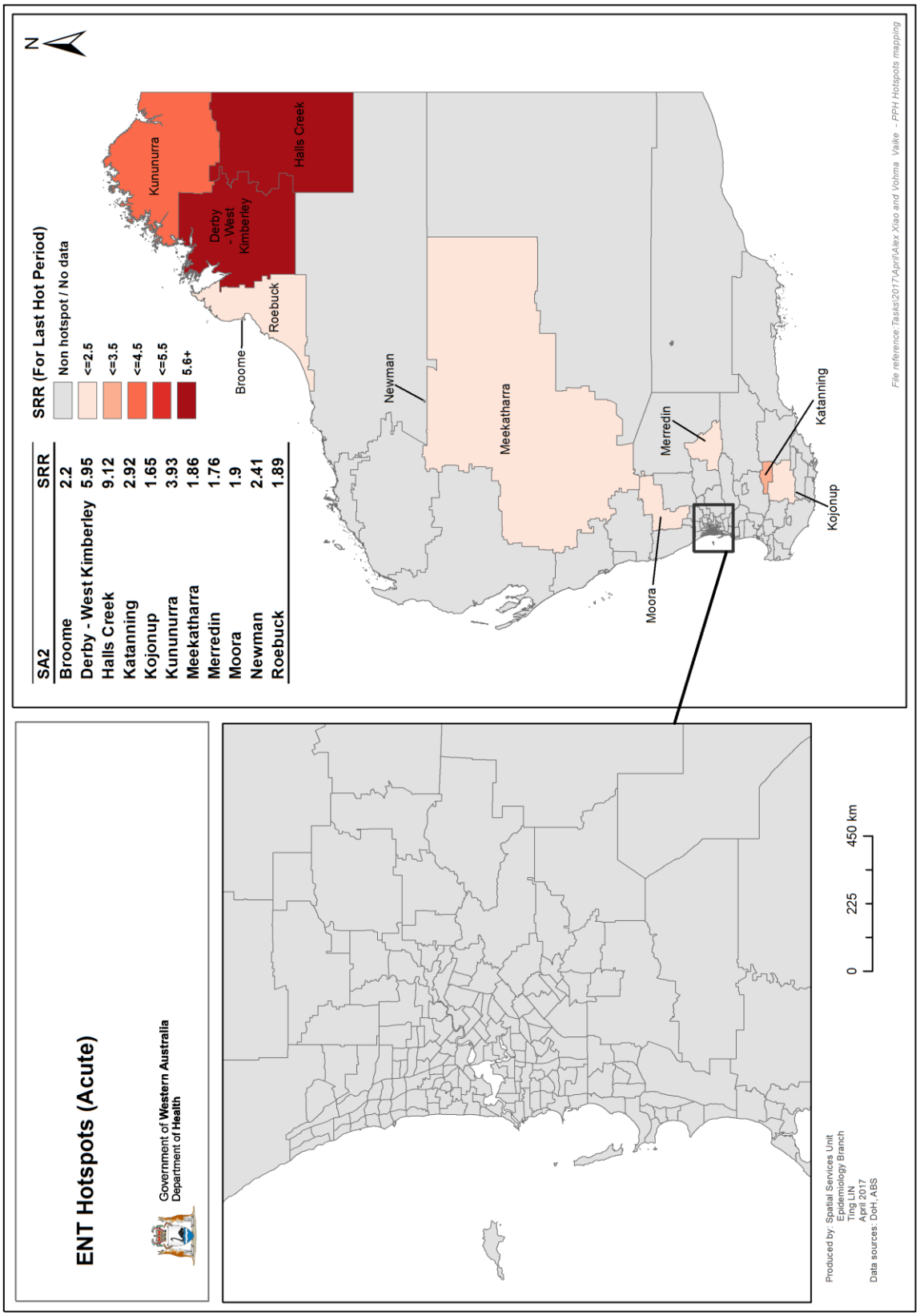
Data sources: DoH, ABS
File reference Tasks\2017\April\Alex Xiao and Vohma Valke - PPH Hotspots mapping

MAP 4


Dental Hotspots (Acute)
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
N
Derby - West Kimberley
NO SA2 Name
1 City Beach
2 Claremont (WA)
3 Cottesloe
4 Duncraig
5 Floreat
6 Hillarys
7 Mosman Park - Peppermint Grov
8 Nedlands - Dalkeith - Crawley
9 Sorrento - Marmion
10 Subiaco - Shenton Park
11 Swanbourne - Mount Claremont
0 225 450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference: Tasks\2017\April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

MAP 5


ENT Hotspots (Acute)
Government of Western Australia
Department of Health
SA2 SRR
Broome 2.2
Derby - West Kimberley 5.95
Halls Creek 9.12
Katanning 2.92
Kojonup 1.65
Kununurra 3.93
Meekatharra 1.86
Merredin 1.76
Moora 1.9
Newman 2.41
Roebuck 1.89
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
N
Kununurra
Derby - West Kimberley
Halls Creek
Broome
Roebuck
Newman
Meekatharra
Merredin
Moora
Katanning
Kojonup
0 225 450 km
Produced by: Spatial Services Unit
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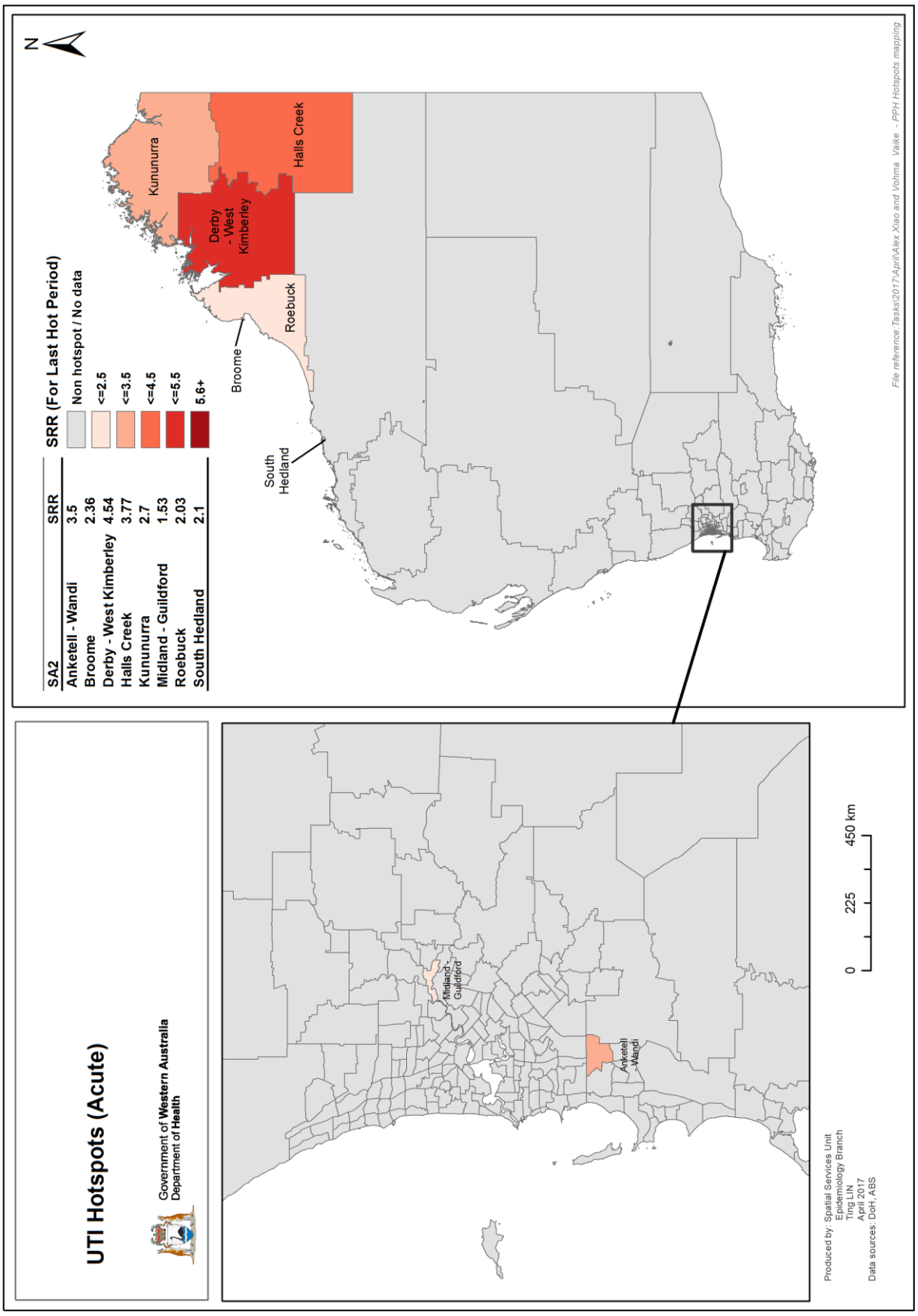
MAP 6


UTI Hotspots (Acute)
Government of Western Australia
Department of Health
SA2 SRR
Anketell - Wandi 3.5
Broome 2.36
Derby - West Kimberley 4.54
Halls Creek 3.77
Kununurra 2.7
Midland - Guildford 1.53
Roebuck 2.03
South Hedland 2.1
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
Kununurra
Halls Creek
Derby - West Kimberley
Roebuck
Broome
South Hedland
Midland - Guildford
Anketell - Wandi
0 225 450 km
N
Produced by: Spatial Services Unit
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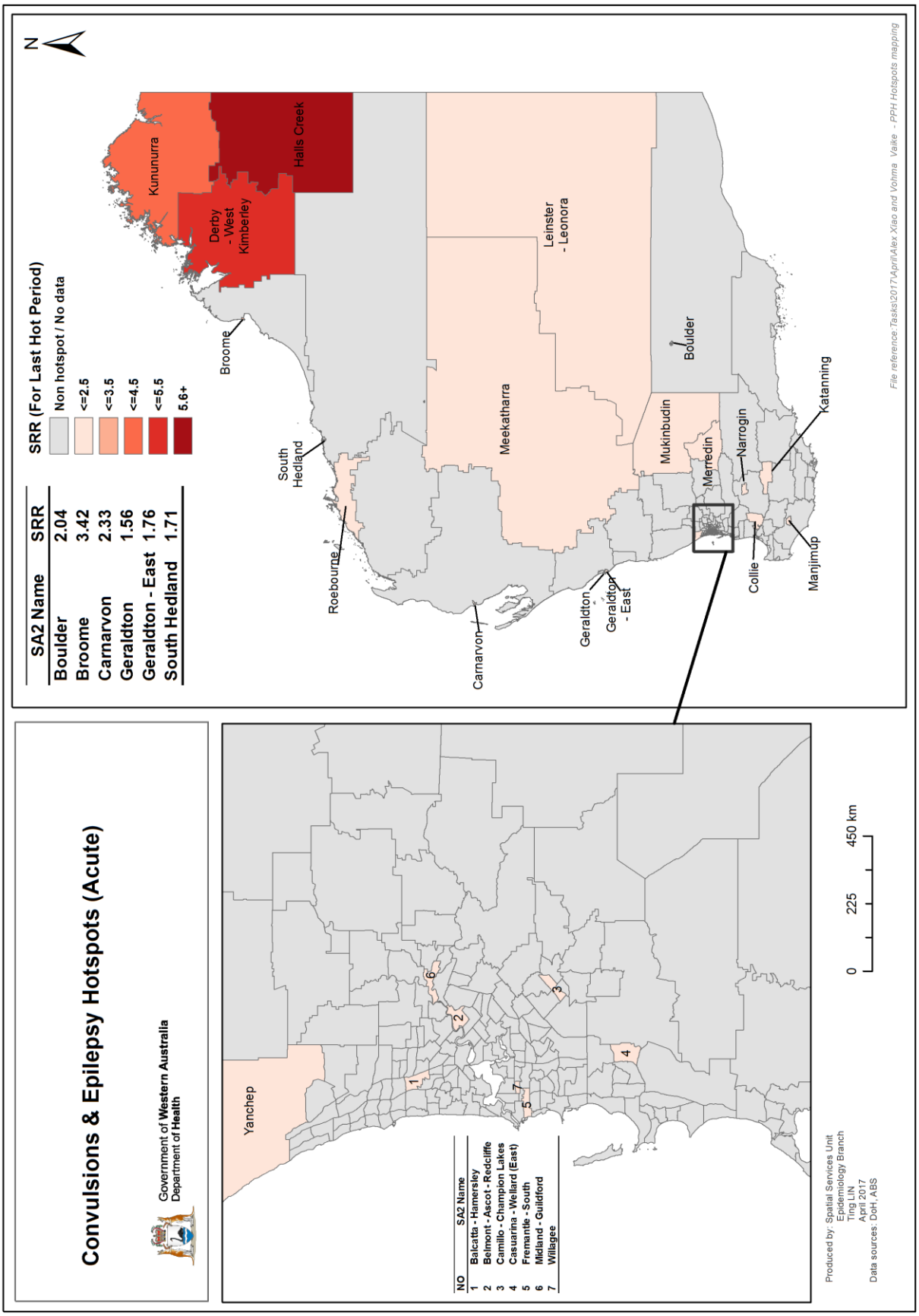
MAP 7


Convulsions & Epilepsy Hotspots (Acute)
Government of Western Australia
Department of Health
N
SA2 Name SRR
Boulder 2.04
Broome 3.42
Carnarvon 2.33
Geraldton 1.56
Geraldton - East 1.76
South Hedland 1.71
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
Kununurra
Halls Creek
Derby - West Kimberley
Broome
South Hedland
Roebourne
Carnarvon
Meekatharra
Leinster - Leonora
Geraldton
Geraldton - East
Boulder
Mukinbudin
Merredin
Narrogin
Collie
Manjimup
Katanning
File reference:Tasks\2017\April\Alex Xiao and Voltma Vaike - PPH Hotspots mapping
NO SA2 Name
1 Balcatta - Hamersley
2 Belmont - Ascot - Redcliffe
3 Camillo - Champion Lakes
4 Casuarina - Wellard (East)
5 Fremantle - South
6 Midland - Guildford
7 Willagee
Yanchep
0 225 450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting Lin
April 2017
Data sources: DoH, ABS

Chronic conditions

All 10 chronic conditions listed in the AIHW PPH definition were analysed together and the top five by volume analysed separately. Those that were not analysed separately had less than 3000 admissions per year on average.

When all 10 conditions were analysed together there were a total of 18 chronic condition hotspots; 14 in country WA and 4 in the metropolitan region. These are listed on the heat map and tabulated below.

PHN	Health Service Provider	SA2	SRR (For last Hot Period)
Country WA	WACHS	Collie	1.58
Country WA	WACHS	Harvey	1.71
Perth North	EMHS	Midland - Guildford	1.72
Perth North	NMHS	Balga - Mirrabooka	1.51
Perth South	SMHS	Casuarina - Wellard (East)	1.67
Perth South	SMHS	Parmelia - Orelia	1.66
Country WA	WACHS	Boulder	2.11
Country WA	WACHS	Kalgoorlie	2.00
Country WA	WACHS	Leinster - Leonora	1.84
Country WA	WACHS	Broome	2.12
Country WA	WACHS	Derby - West Kimberley	4.09
Country WA	WACHS	Halls Creek	4.45
Country WA	WACHS	Kununurra	2.65
Country WA	WACHS	Roebuck	2.71
Country WA	WACHS	Geraldton - East	1.75
Country WA	WACHS	Meekatharra	2.05
Country WA	WACHS	South Hedland	2.76
Country WA	WACHS	Katanning	1.66

The whole of the Kimberley region was a hotspot for these chronic conditions, particularly Halls Creek and Derby – West Kimberley with rates of admissions more than four times the state average. Both Broome and Derby – West Kimberley had on average over 200 admissions for these conditions for the period from 2013/14 to 2015/16 inclusive.

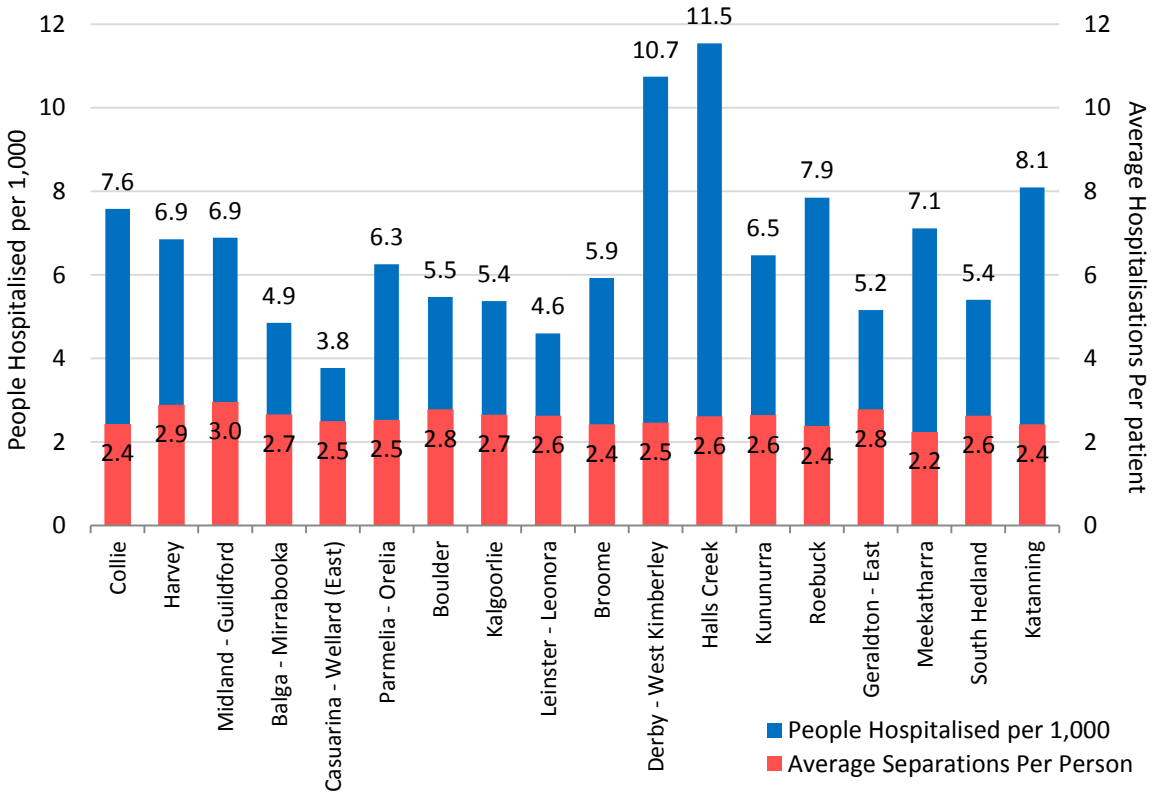
In the metropolitan region, hotspots for chronic conditions examined together included Midland – Guildford and Balga – Mirrabooka with age standardised rates of hospitalisation 1.7 and 1.5 times the state average. In the South, hotspots included Parmelia – Orelia and Casuarina – Wellard (East) with SRRs of 1.7 each.

All chronic condition hotspots are represented in the graph below, together with the crude rate of the number of people hospitalised per 1000 of the local SA2 population and the average number of separations per patient on average for the 2013/14 to 2015/16 financial years. Halls Creek and Derby – West Kimberley stand out in terms of the crude rate of the number of people admitted per 1000 of the population as does Katanning, with 11.5, 10.7 and 8.1 admissions per 1000 respectively (Figure 3).

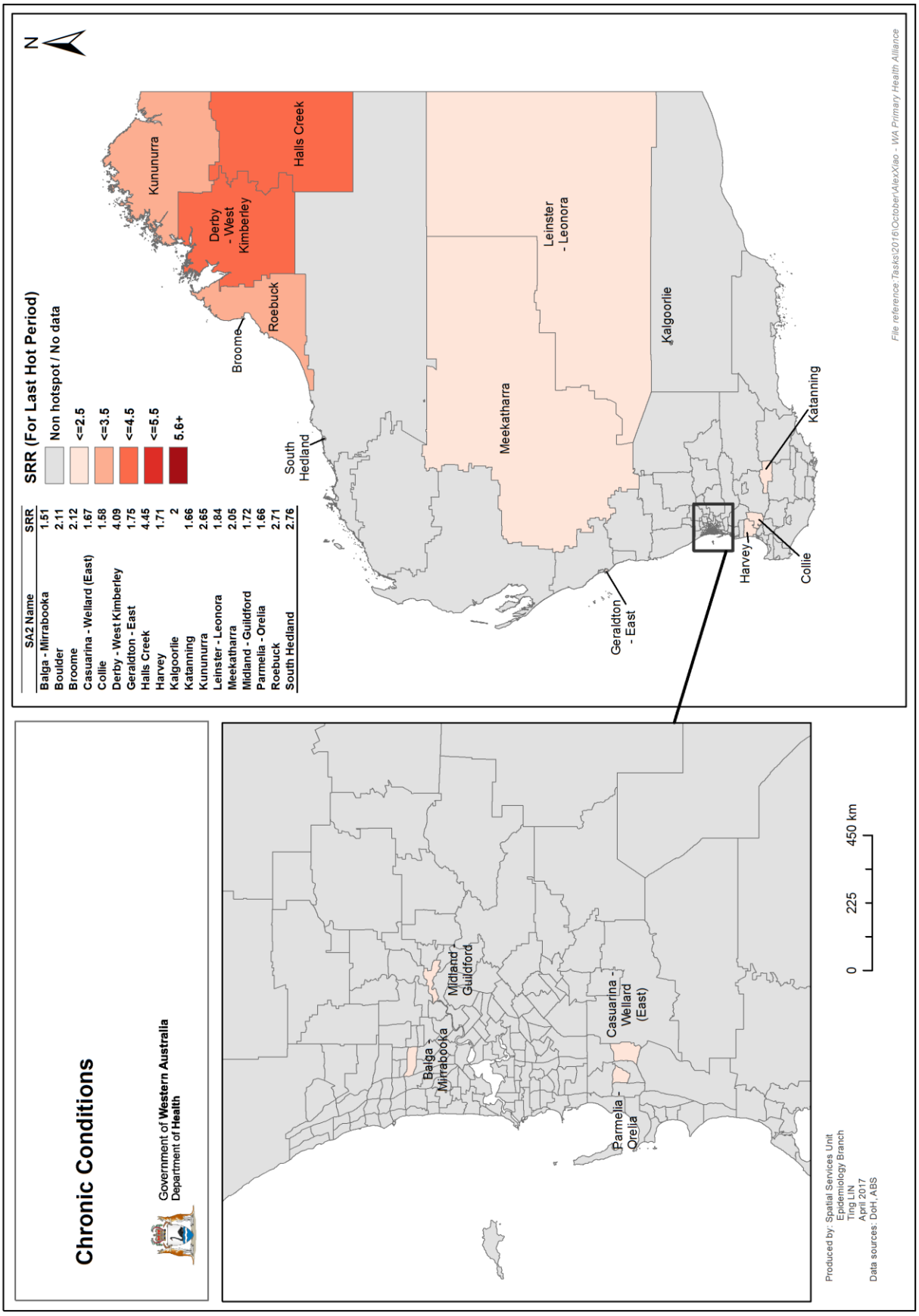
This may be representative of the inequity in primary and community care, with less primary care available for chronic conditions in these areas resulting in a greater uptake of tertiary

services. Remarkably, the average number of chronic condition hospitalisations per patient in each hotspot is very similar, at 2.2 to 3.0 admissions per patient. This means patients were readmitted at least once in three years, after their initial visit. The greatest volume of admissions belonged to Balga – Mirrabooka (~270 per annum) which reflects its large population (~21 000 in 2015) relative to other hotspots for chronic conditions.

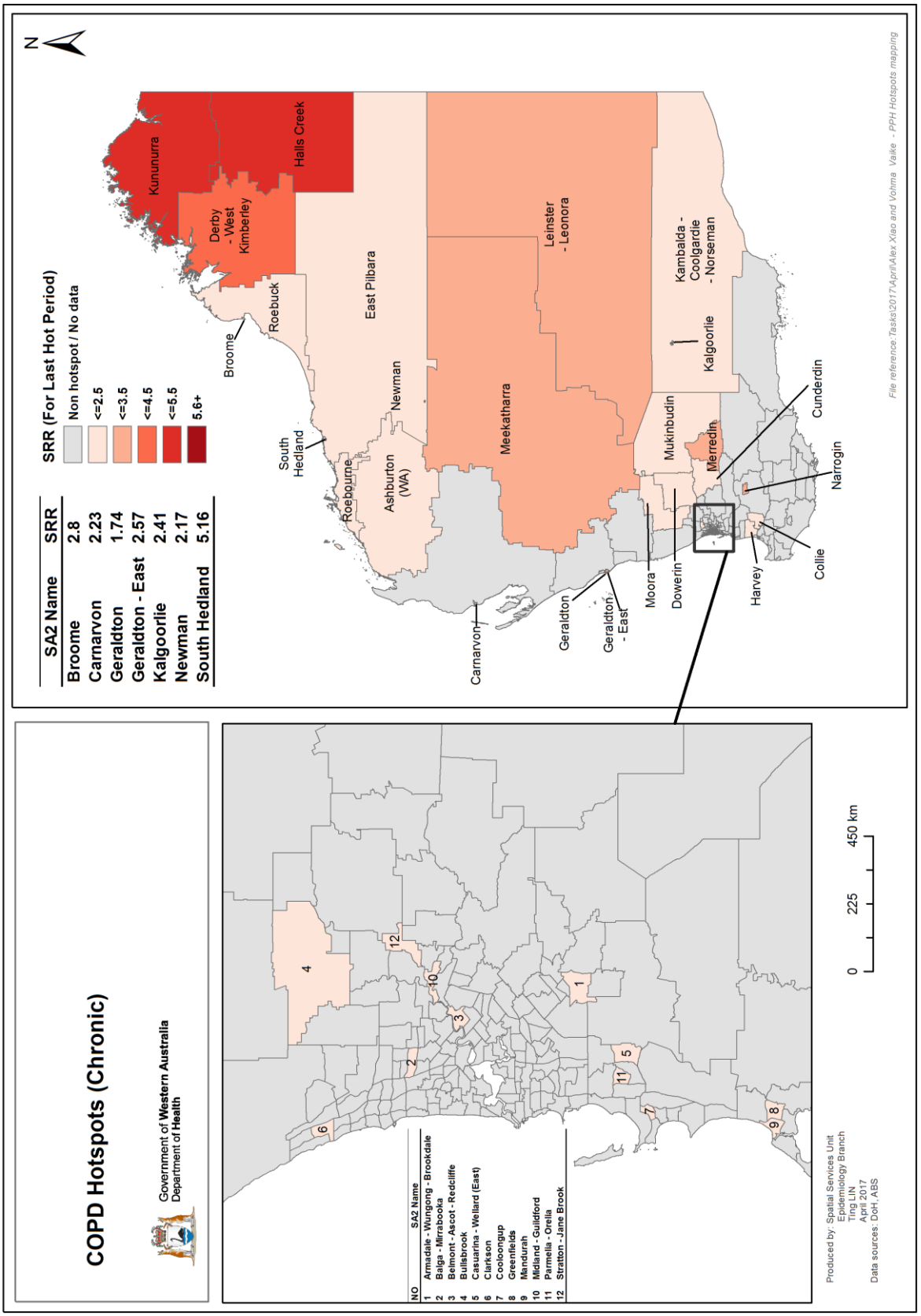
Figure 3. Chronic condition hotspots – people admitted per 1000 population and hospitalisations per patient



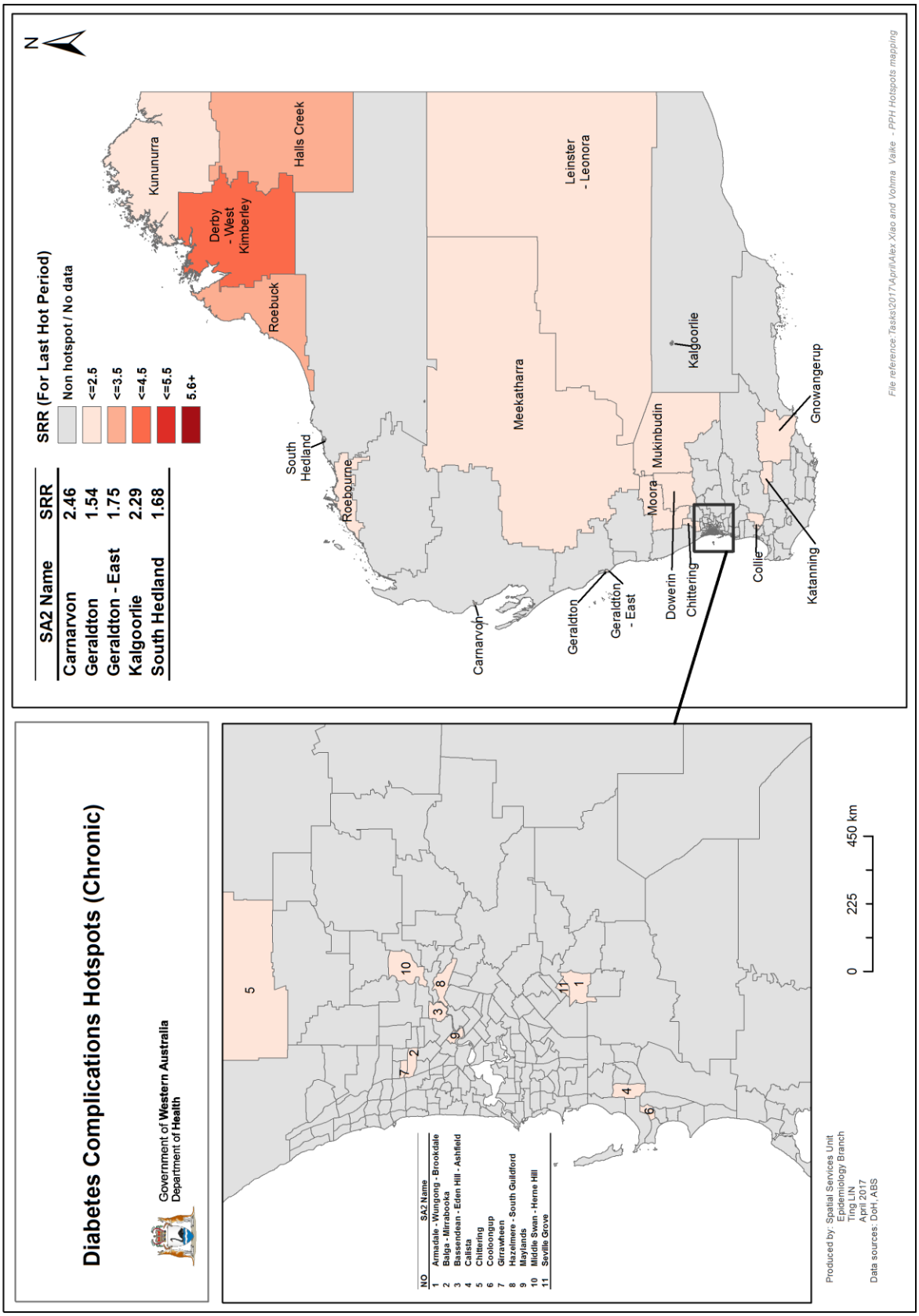
MAP 8


Chronic Conditions
Government of Western Australia
Department of Health
SA2 Name SRR
Balga - Mirrabooka 1.51
Boulder 2.11
Broome 2.12
Casuarina - Wellard (East) 1.67
Collie 1.58
Derby - West Kimberley 4.09
Geraldton - East 1.75
Halls Creek 4.45
Harvey 1.71
Kalgoorlie 2
Katanning 1.66
Kununurra 2.65
Leinster - Leonora 1.84
Meekatharra 2.05
Midland - Guildford 1.72
Parmelia - Orelia 1.66
Roebuck 2.71
South Hedland 2.76
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
N
Kununurra
Halls Creek
Derby - West Kimberley
Broome
Roebuck
South Hedland
Meekatharra
Leinster - Leonora
Kalgoorlie
Geraldton - East
Harvey
Collie
Katanning
Balga - Mirrabooka
Midland - Guildford
Casuarina - Wellard (East)
Parmelia - Orelia
0
225
450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference:Tasks\2016\October\AlexXiao - WA Primary Health Alliance

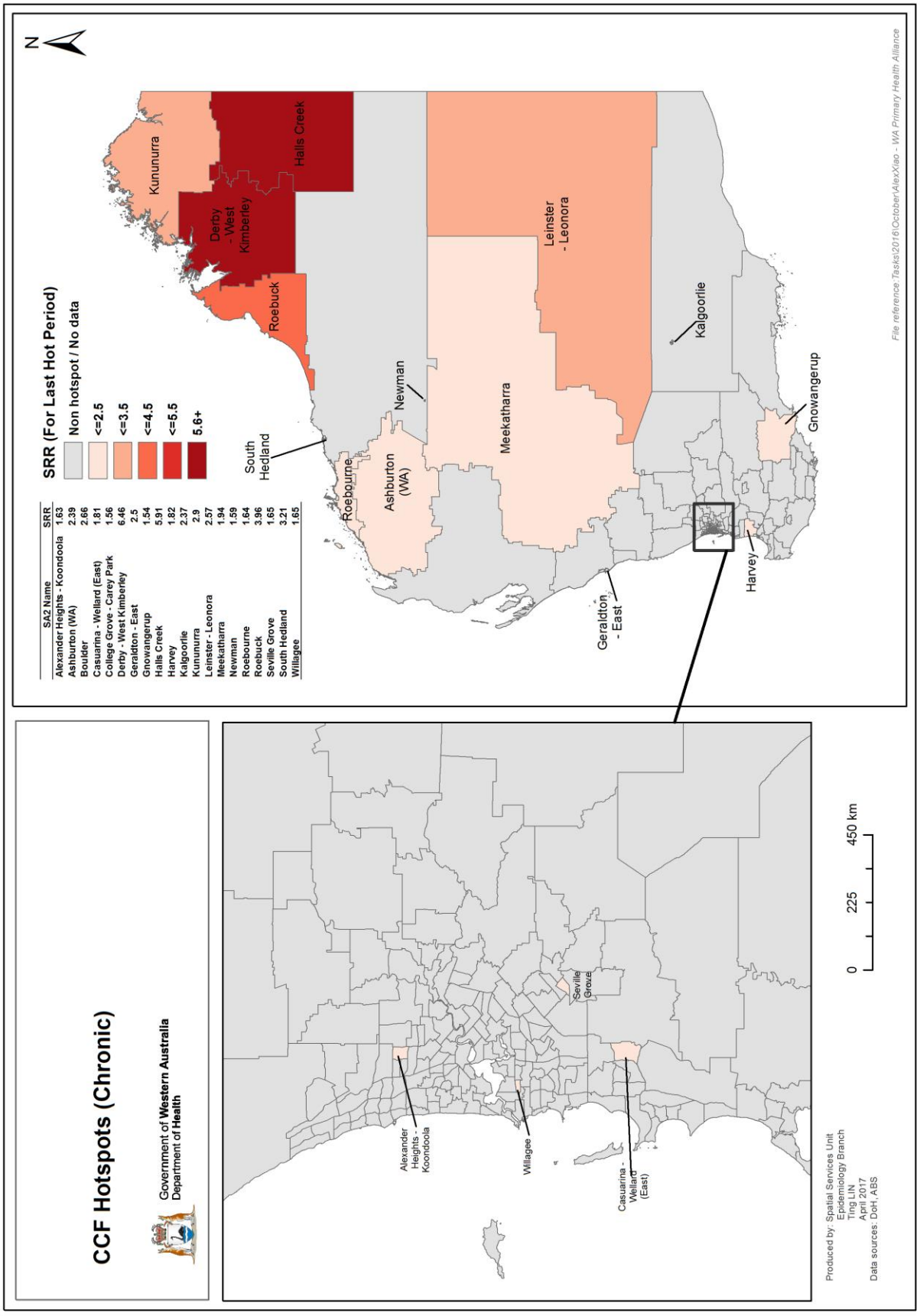
MAP 9


COPD Hotspots (Chronic)
Government of Western Australia
Department of Health
SA2 Name SRR
Broome 2.8
Carnarvon 2.23
Geraldton 1.74
Geraldton - East 2.57
Kalgoorlie 2.41
Newman 2.17
South Hedland 5.16
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
N
Kununurra
Halls Creek
Derby - West Kimberley
Broome
Roebuck
East Pilbara
Newman
South Hedland
Roebourne
Ashburton (WA)
Meekatharra
Leinster - Leonora
Kambalda - Coolgardie - Norseman
Kalgoorlie
Mukinbudin
Merredin
Cunderdin
Narrogin
Carnarvon
Geraldton
Geraldton - East
Moora
Dowerin
Harvey
Collie
NO SA2 Name
1 Armadale - Wungong - Brookdale
2 Balga - Mirrabooka
3 Belmont - Ascot - Redcliffe
4 Bullsbrook
5 Casuarina - Wellard (East)
6 Clarkson
7 Cooloongup
8 Greenfields
9 Mandurah
10 Midland - Guildford
11 Parmelia - Orelia
12 Stratton - Jane Brook
0 225 450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference:Tasks\2017\April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

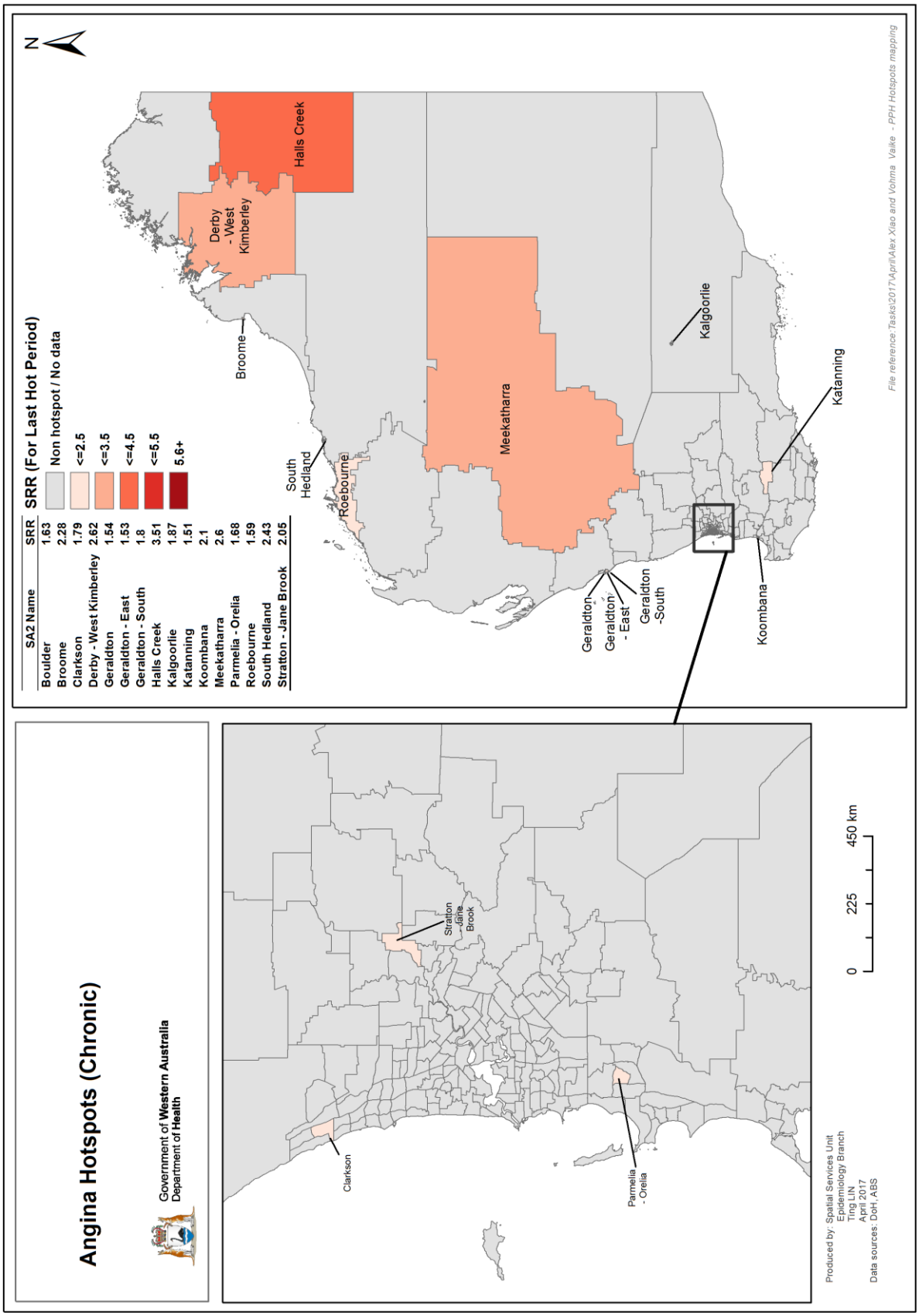
MAP 10


Diabetes Complications Hotspots (Chronic)
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Carnarvon 2.46
Geraldton 1.54
Geraldton - East 1.75
Kalgoorlie 2.29
South Hedland 1.68
Kununurra
Halls Creek
Derby - West Kimberley
Roebuck
South Hedland
Roebourne
Carnarvon
Meekatharra
Leinster - Leonora
Kalgoorlie
Mukinbudin
Moora
Geraldton
Geraldton - East
Dowerin
Chittering
Collie
Katanning
Gnowangerup
NO SA2 Name
1 Armadale - Wungong - Brookdale
2 Balga - Mirrabooka
3 Bassendean - Eden Hill - Ashfield
4 Calista
5 Chittering
6 Cooloongup
7 Girrawheen
8 Hazelmere - South Guildford
9 Maylands
10 Middle Swan - Herne Hill
11 Seville Grove
0 225 450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference:Tasks\2017April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

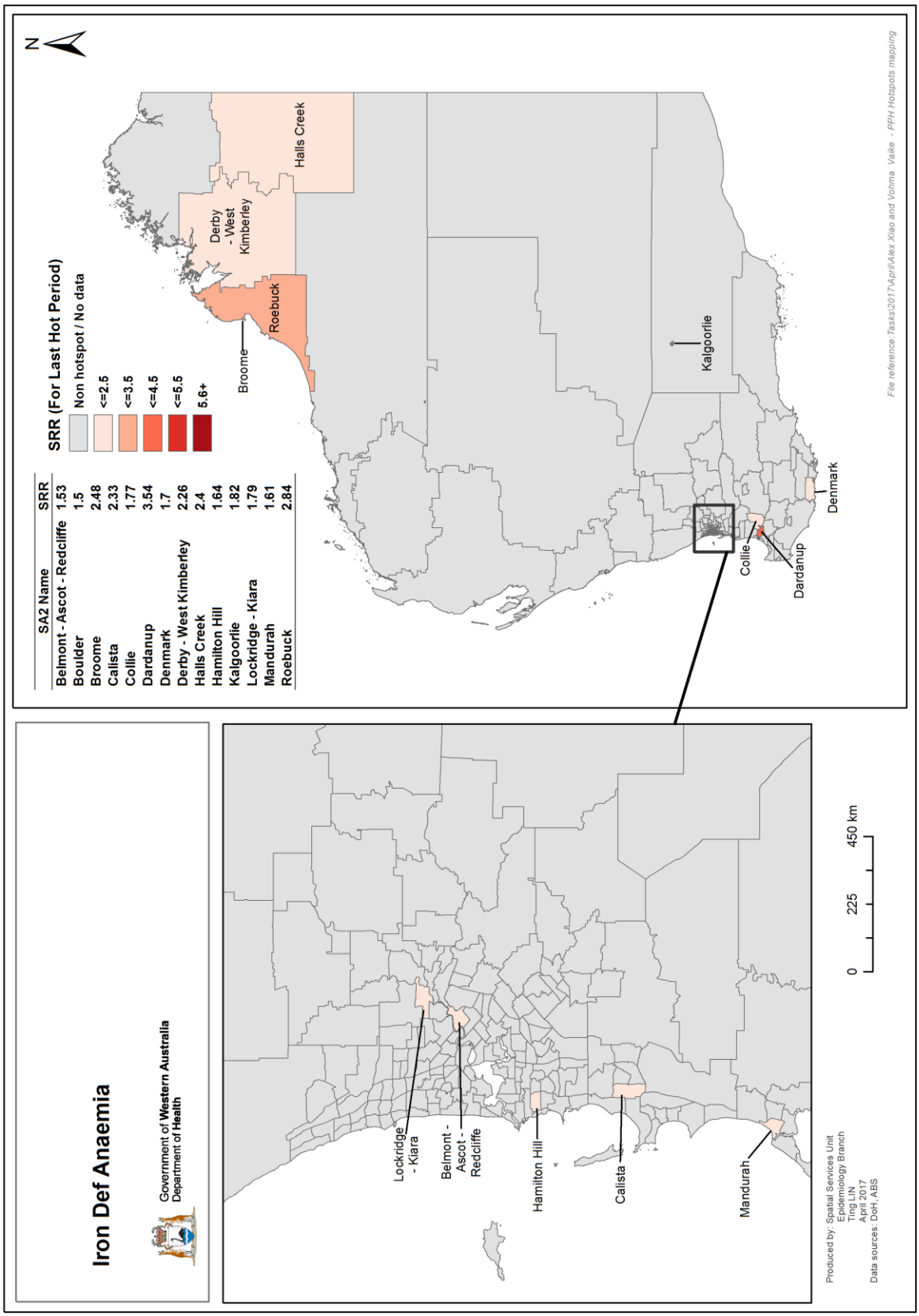
MAP 11


CCF Hotspots (Chronic)
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Alexander Heights - Koondoola 1.63
Ashburton (WA) 2.39
Boulder 2.66
Casuarina - Wellard (East) 1.81
College Grove - Carey Park 1.56
Derby - West Kimberley 6.46
Geraldton - East 2.5
Gnowangerup 1.54
Halls Creek 5.91
Harvey 1.82
Kalgoorlie 2.37
Kununurra 2.9
Leinster - Leonora 2.57
Meekatharra 1.94
Newman 1.59
Roebourne 1.64
Roebuck 3.96
Seville Grove 1.65
South Hedland 3.21
Willagee 1.65
Kununurra
Halls Creek
Derby - West Kimberley
Roebuck
South Hedland
Newman
Roebourne
Ashburton (WA)
Meekatharra
Leinster - Leonora
Kalgoorlie
Gnowangerup
Geraldton - East
Harvey
N
File reference Tasks\2016\October\AlexXiao - WA Primary Health Alliance
Alexander Heights - Koondoola
Willagee
Seville Grove
Casuarina - Wellard (East)
0
225
450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS

MAP 12


Angina Hotspots (Chronic)
Government of Western Australia
Department of Health
SA2 Name SRR
Boulder 1.63
Broome 2.28
Clarkson 1.79
Derby - West Kimberley 2.62
Geraldton 1.54
Geraldton - East 1.53
Geraldton - South 1.8
Halls Creek 3.51
Kalgoorlie 1.87
Katanning 1.51
Koombana 2.1
Meekatharra 2.6
Parmelia - Orelia 1.68
Roebourne 1.59
South Hedland 2.43
Stratton - Jane Brook 2.05
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
N
Halls Creek
Derby - West Kimberley
Broome
South Hedland
Roebourne
Meekatharra
Kalgoorlie
Katanning
Geraldton
Geraldton - East
Geraldton -South
Koombana
Stratton - Jane Brook
Clarkson
Parmelia - Orelia
0
225
450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference:Tasks\2017April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

MAP 13


Iron Def Anaemia
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Belmont - Ascot - Redcliffe 1.53
Boulder 1.5
Broome 2.48
Calista 2.33
Collie 1.77
Dardanup 3.54
Denmark 1.7
Derby - West Kimberley 2.26
Halls Creek 2.4
Hamilton Hill 1.64
Kalgoorlie 1.82
Lockridge - Kiara 1.79
Mandurah 1.61
Roebuck 2.84
Broome
Roebuck
Derby - West Kimberley
Halls Creek
Kalgoorlie
Collie
Dardanup
Denmark
Lockridge - Kiara
Belmont - Ascot - Redcliffe
Hamilton Hill
Calista
Mandurah
0 225 450 km
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference:Tasks\2017\April\Alex Xiao and Volnma Vaike - PPH Hotspots mapping

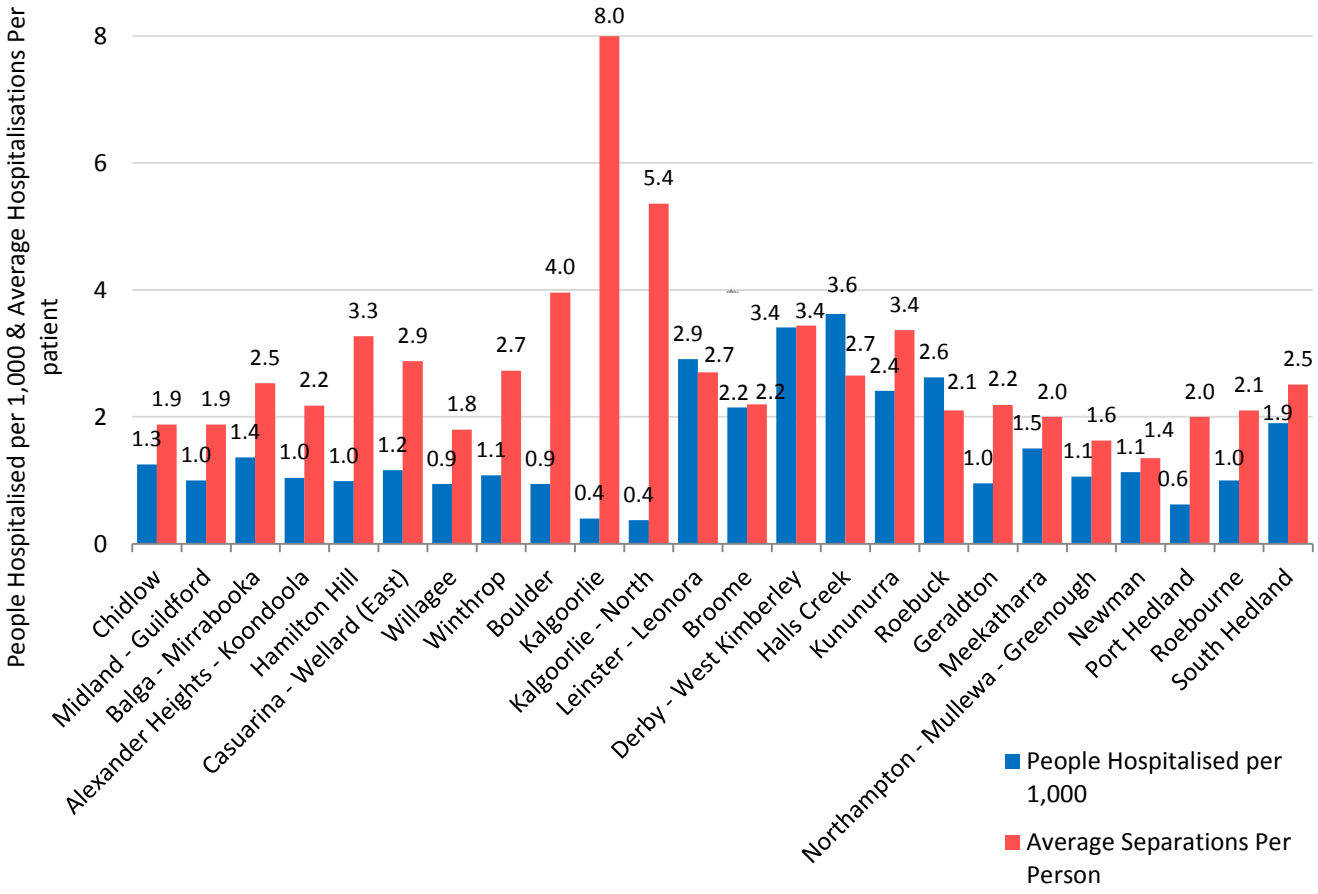
Vaccine-preventable conditions

Vaccine-preventable conditions included instances of influenza and pneumonia that were vaccine-preventable as well as diseases that could have been avoided through childhood vaccinations such as diphtheria, whooping cough and measles. There were 24 hotspots found for vaccine-preventable conditions, 16 in country WA and 8 in the metropolitan area.

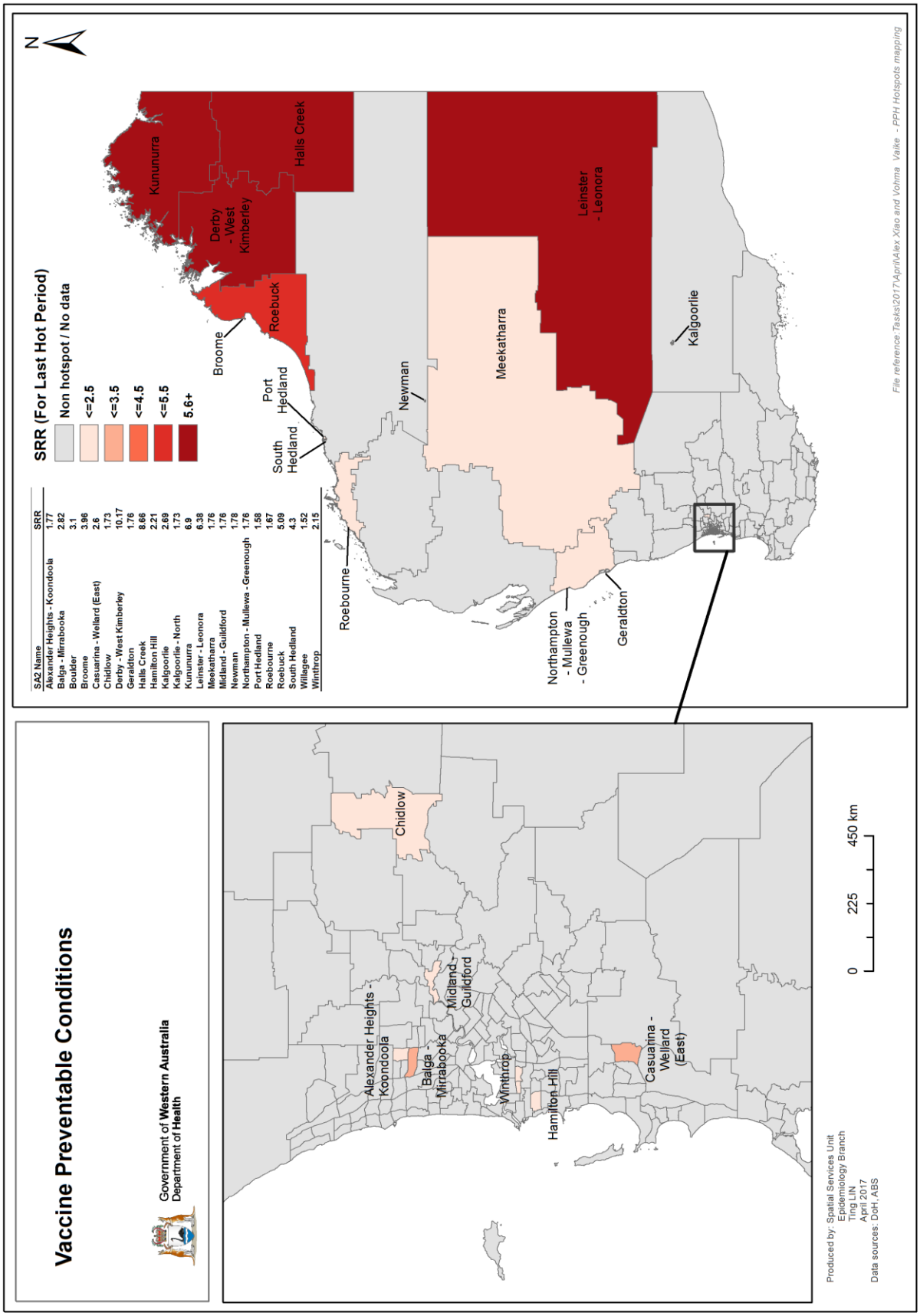
The whole of the Kimberley region was a hotspot for vaccine-preventable conditions with Derby - West Kimberley and Halls Creek having the highest age-standardised rates of admissions at more than 10 and 8 times the state average respectively. The Goldfields region captures high numbers of repeat admissions indicating the region had a small number of frequent presenters.

A comparison of the number or people admitted per 1000 of the hotspot population and the average number of admissions per patient is provided below. The number of people admitted per 1000 of the population for vaccine-preventable conditions is much smaller than for acute and chronic condition hotspots (1.5 on average compared to 15.8 vs 6.7). The number of repeat admissions per patient may be much higher (e.g. 8 admissions per patient in Kalgoorlie compared with 1.9 and 2.6 on average for acute and chronic conditions respectively). There is greater variation in the number of repeat admissions (from 1.4 in Newman to 8.0 in Kalgoorlie) (Figure 4).

Figure 4. Vaccine-preventable condition hotspots – people admitted per 1000 population and hospitalisations per patient



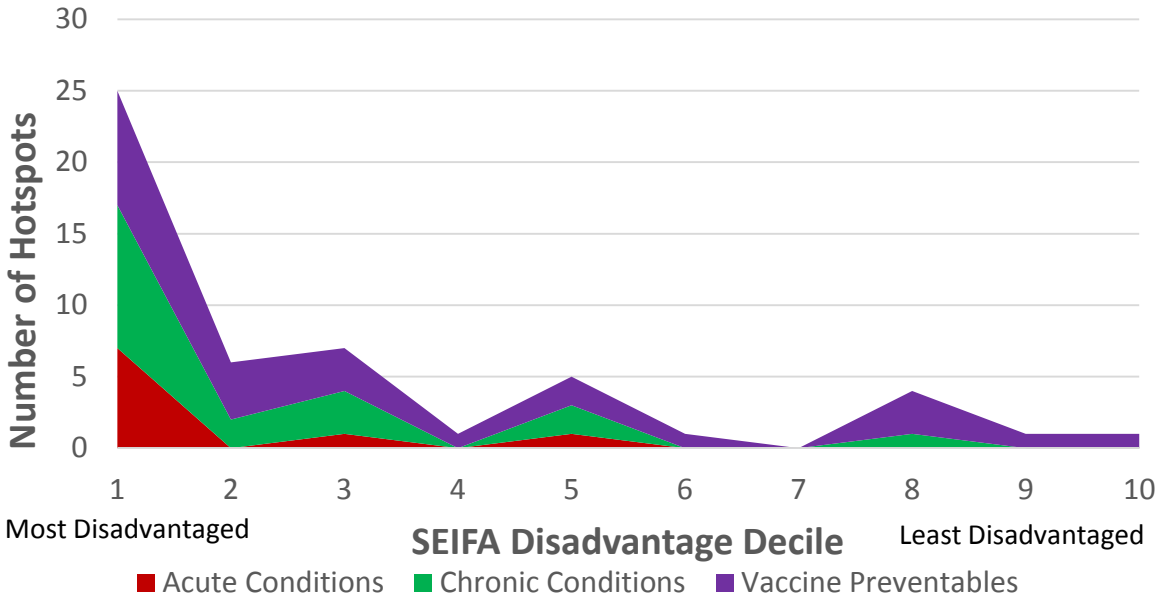
MAP 14


Vaccine Preventable Conditions
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Alexander Heights - Koondoola 1.77
Balga - Mirrabooka 2.82
Boulder 3.1
Broome 3.96
Casuarina - Wellard (East) 2.6
Chidlow 1.73
Derby - West Kimberley 10.17
Geraldton 1.76
Halls Creek 8.66
Hamilton Hill 2.21
Kalgoorlie 2.69
Kalgoorlie - North 1.73
Kununurra 6.9
Leinster - Leonora 6.38
Meekatharra 1.76
Midland - Guildford 1.76
Newman 1.78
Northampton - Mullewa - Greenough 1.76
Port Hedland 1.58
Roebourne 1.67
Roebuck 5.09
South Hedland 4.3
Willagee 1.52
Winthrop 2.15
Kununurra
Halls Creek
Derby - West Kimberley
Broome
Roebuck
Port Hedland
South Hedland
Roebourne
Newman
Meekatharra
Leinster - Leonora
Kalgoorlie
Northampton - Mullewa - Greenough
Geraldton
Chidlow
Alexander Heights - Koondoola
Balga - Mirrabooka
Midland - Guildford
Winthrop
Hamilton Hill
Casuarina - Wellard (East)
0
225
450 km
N
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DoH, ABS
File reference:Tasks\2017\April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping

Socioeconomic disadvantage and hotspots

Generally, as SEIFA deciles increase and the area experiences less socioeconomic disadvantage, the number of hotspots found declines. This correlation is especially true for acute and chronic condition PPHs, as depicted in Figure 5.

Figure 5. Number of hotspots by socioeconomic index for areas disadvantage decile (acute, chronic and vaccine-preventable conditions examined collectively)



For the major groupings of vaccine-preventable, acute and chronic conditions as well as the top ten PPH conditions by volume, a statistically significant association was found with SEIFA disadvantage decile. For all PPHs excluding those for dental conditions, as the socioeconomic disadvantage of the area decreases (as indicated by higher SIEFA deciles), it is on average less likely to qualify as a hotspot.

Aboriginality[1] and hotspots

Despite their being many more areas where the proportion of the Aboriginal people in the population is less than 3%, it is the areas with larger Aboriginal populations that were more likely to qualify as hotspots, especially for PPHs due to acute conditions.

The proportion of Aboriginal people in an area was found to be a statistically significant predictor for qualification as a hotspot for all PPH conditions and major categories examined, except for convulsions and epilepsy and dental conditions. Thus, for all PPH types except those mentioned, an increase in the proportion of the Aboriginal population in the area, resulted in the area on average, being more likely to qualify as a hotspot.

Of the 177 SA2s in the state where Aboriginal people made up 0 to 4% of the population, only three of those were hotspots for chronic conditions and only four were for vaccine-preventable conditions. In contrast, there were only three SA2s with the majority of their population Aboriginal and all three of these were hotspots for all of the major categories of PPHs considered (Figure 6).

[1] Percentage Aboriginal was measured as Percentage Aboriginal and Torres Strait Islander (ATSI). To ensure consistency, it is recognised that the WA Department of Health uses 'Aboriginal' instead of ATSI in all of its documents as is preferred by the local Aboriginal population.

Figure 6. Number of hotspots by proportion of Aboriginal people in the population

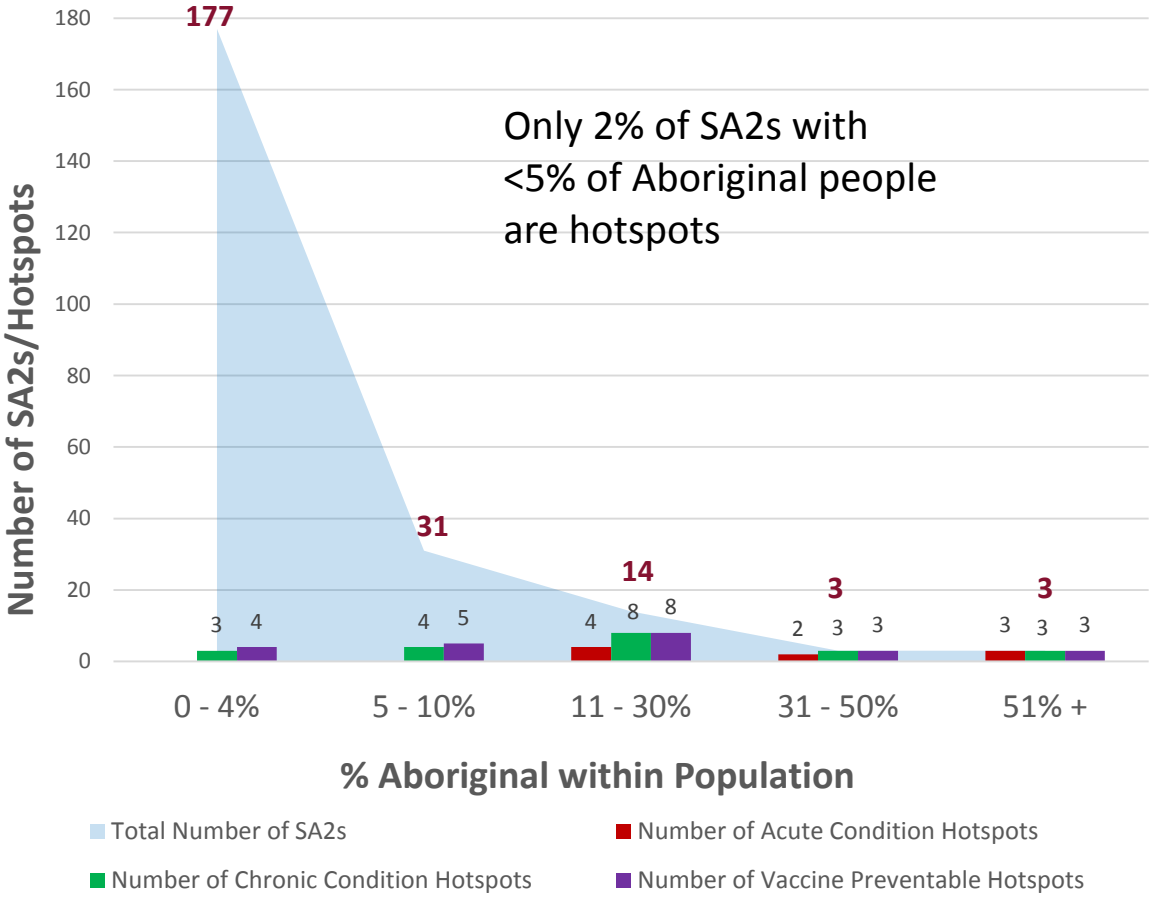
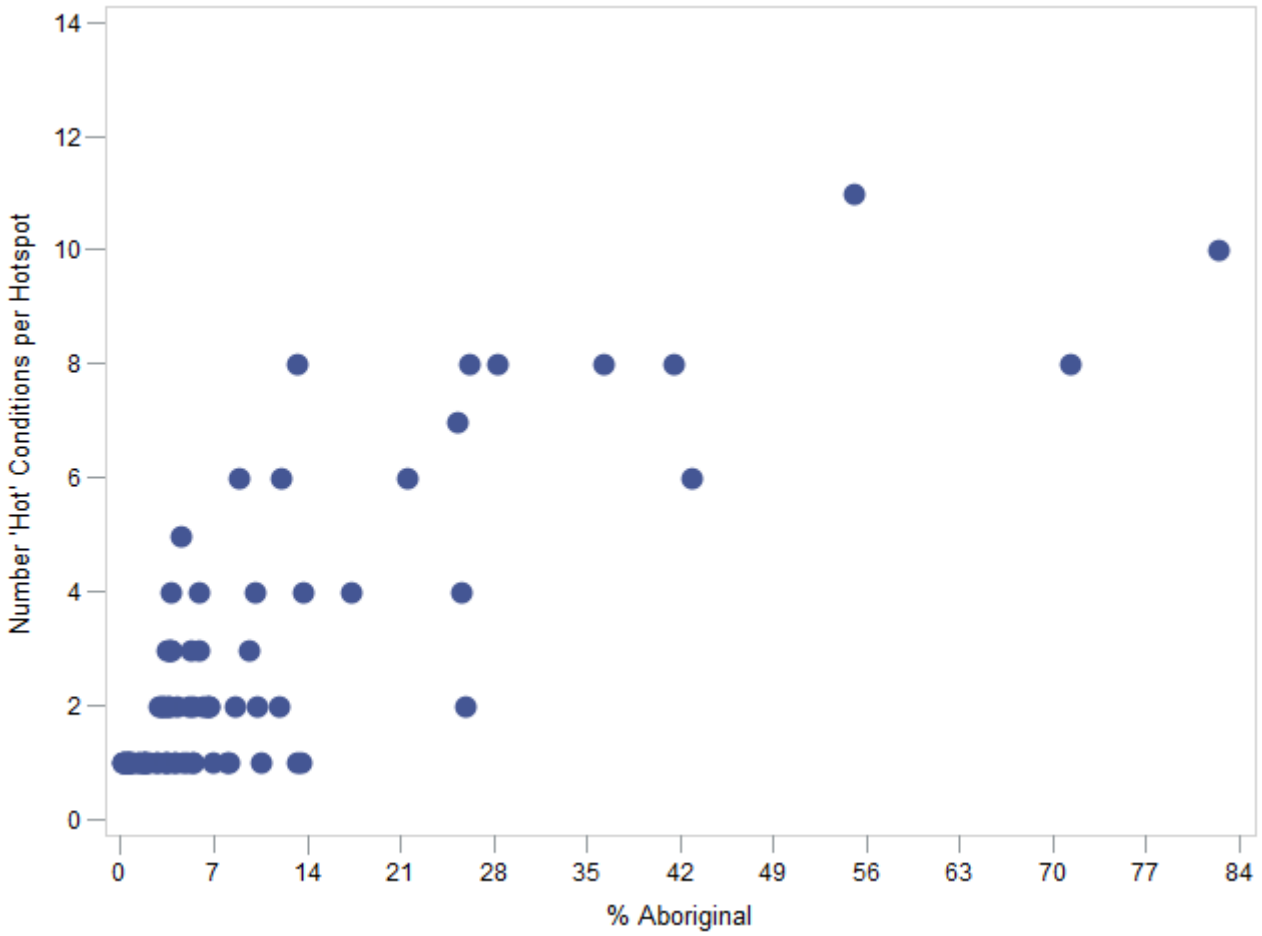


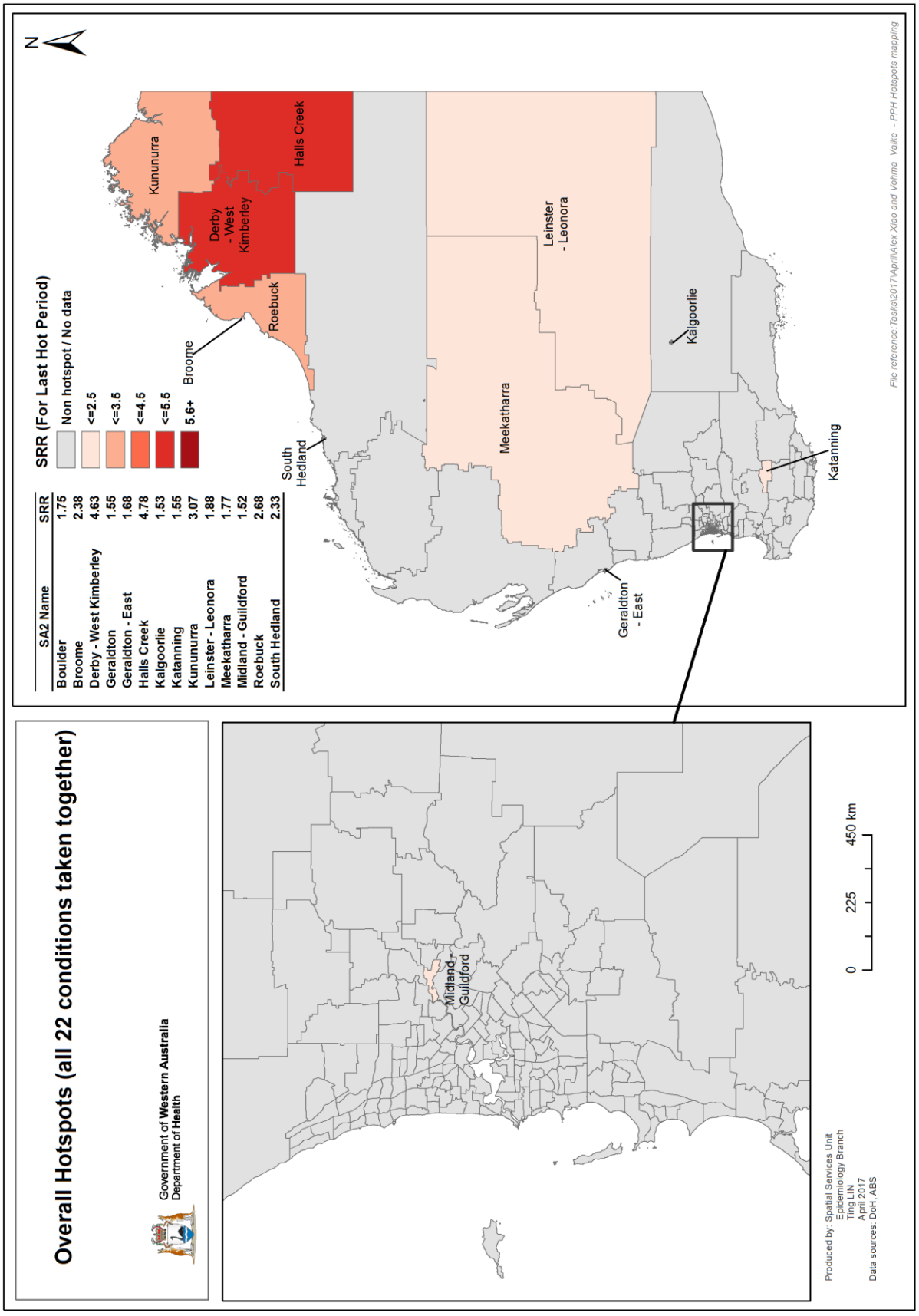
Figure 7 depicts the significant correlation between the proportion of Aboriginal people in the population and the number of conditions for which the SA2 qualified as a hotspot. A very strong positive correlation is depicted here. As the proportion of Aboriginal people in the SA2 increases, the number of conditions the area qualifies as a hotspot for increases (Figure 7).

Figure 7. Number of 'hot' conditions per hotspot by proportion Aboriginal in SA2 population



By far the greatest need in terms of PPHs occurs in country WA, particularly in the Kimberley – When all 22 PPH conditions are examined together the Kimberley stands apart from the rest of Western Australia (Map 15).

MAP 15


Overall Hotspots (all 22 conditions taken together)
Government of Western Australia
Department of Health
SRR (For Last Hot Period)
Non hotspot / No data
<=2.5
<=3.5
<=4.5
<=5.5
5.6+
SA2 Name SRR
Boulder 1.75
Broome 2.38
Derby - West Kimberley 4.63
Geraldton 1.55
Geraldton - East 1.68
Halls Creek 4.78
Kalgoorlie 1.53
Katanning 1.55
Kununurra 3.07
Leinster - Leonora 1.88
Meekatharra 1.77
Midland - Guildford 1.52
Roebuck 2.68
South Hedland 2.33
Kununurra
Derby - West Kimberley
Halls Creek
Broome
Roebuck
South Hedland
Meekatharra
Leinster - Leonora
Kalgoorlie
Katanning
Geraldton - East
Midland - Guildford
0 225 450 km
N
File reference:Tasks\2017\April\Alex Xiao and Vohma Vaike - PPH Hotspots mapping
Produced by: Spatial Services Unit
Epidemiology Branch
Ting LIN
April 2017
Data sources: DOH, ABS

Summary of regional difference/highlights

The area of greatest need is the Kimberley. Each area in the Kimberley is a hotspot for multiple conditions. Each Kimberley area was also a hotspot for all PPHs considered collectively and each major category of acute, chronic and vaccine-preventable conditions. The hotspots with the greatest SRRs and the greatest inequity of outcome were Derby – West Kimberley and Halls Creek, particularly for PPHs due to vaccine-preventable conditions.

The Kimberley was positive for the two strong predictors of hotspots, socioeconomic disadvantage and large proportions of Aboriginal people. All areas within the Kimberley region had a high proportion of Aboriginal people within their populations, the highest being Halls Creek (82%) and Derby – West Kimberley (55%). The lowest was Broome (28%) and the state average was 3%. All areas, except Broome, were in the 10% of most socioeconomically disadvantaged areas. Broome however was in the top 30% of most disadvantaged areas.

The Pilbara was the area of second greatest need, particularly Roebourne and South Hedland. Both were hotspots for vaccine-preventable conditions and South Hedland was also a hotspot for 7 of the top 10 conditions by volume. Roebourne was also a hotspot for 6 of the top 10 conditions by volume. The greatest inequity within the Pilbara occurred in South Hedland for COPD, with admissions rates 5 times the state average. The Pilbara contained 5 hotspots for COPD. This was the condition resulting in greatest need within the Pilbara. Other conditions that often yielded hotspots within the region were cellulitis and CCF, with 4 hotspots each.

The Goldfields and Mid West both had one area that was a hotspot for 7 of the top 10 conditions by volume as well as vaccine-preventable conditions. These were Boulder in the Goldfields and Meekatharra in the Mid West. Other areas with multiple hotspot conditions in the Goldfields were Kalgoorlie and Leinster – Leonora and Geraldton and Geraldton – East in the Mid West. Leinster – Leonora had admission rates for vaccine-preventable conditions 6.4 times the state average. Leinster – Leonora included the Ngaanytjarra Lands. Goldfields condition hotspots included COPD, diabetes complications, CCF and vaccine-preventable conditions. The Mid West qualified as a hotspot in 4 different areas for angina and had 3 hotspots each for vaccine-preventable conditions, cellulitis, convulsions and epilepsy, COPD and diabetes complications.

Wheatbelt – North had 5 hotspots for COPD and 4 for diabetes complications. These were Chittering, Cunderdin, Dowerin, Merredin, Moora and Mukinbudin. Narrogin, in Wheatbelt – South was also as hotspots for both COPD and diabetes complication PPHs.

College Grove – Carey Park, Collie and Harvey within the South West Health Region were likewise hotspots for COPD. Dardanup and Collie were hotspots for iron deficiency anaemia PPHs. Dardanup had a rate of inpatient admission for iron deficiency anaemia 3.5 times the state average of the 2013/14 to 2015/16 period.

Katanning in the Albany area qualified as a hotspot for convulsions and epilepsy, ENT infections, angina and diabetes complications. Katanning was the area of greatest need within Albany.

In the North Metropolitan region, Midland – Guildford in Swan was the area of greatest need, qualifying as a hotspot for 4 of the top 10 conditions by volume as well as vaccine-preventable conditions. It was a hotspot for cellulitis, convulsions and epilepsy, UTIs and COPD. Balga – Mirrabooka in Stirling was a hotspot for vaccine-preventable conditions, COPD and diabetes complications with an admission rate 2.8 times the state average for vaccine-preventable conditions.

The North Metropolitan area included 6 hotspots for diabetes complications in Balga – Mirrabooka, Girrawheen, Bassendean – Eden Hill – Ashfield, Middle Swan – Herne Hill,

Hazelmere – South Guildford, and Maylands. There were a further 5 hotspots for COPD in Clarkson, Balga – Mirrabooka, Bullsbrook, Midland – Guildford and Stratton – Jane Brook.

Dental condition hotspots were prevalent in the Cottesloe – Claremont area. This included Floreat, Nedlands – Dalkeith – Crawley and Swanbourne – Mount Claremont as well as others. The highest SRR was observed in City Beach. Another 3 hotspots for dental conditions were located in the Joondalup area, being Duncraig, Hillarys and Sorrento – Marmion. Further investigation found an overwhelming association between dental condition hotspots and private health insurance. In areas that qualified as hotspots for dental conditions, the proportion of admissions that were funded by private health insurance was on average 86%, as opposed to 70% for non-hotpot areas. Therefore the ability of people within an area to have their dental hospital admissions covered by private health insurance was significantly predictive for qualification as a dental hotspot.

A prison population of possibly around 40% should be taken into consideration when looking at Chidlow as a PPH hotspot. Note that it is the only hotspot within the Swan and Hills Health District and likely due to the presence of Wooroloo and Acacia prisons in the area.

Casuarina – Wellard (East) and Willagee were the areas in the South Metropolitan region that qualified as hotspots for the most conditions. It must be noted that there is a substantial prison population in Casuarina – Wellard (East) which may make up around 40% of the total areas. Regardless, Casuarina – Wellard (East) qualifies as a hotspot for vaccine-preventable conditions, convulsions and epilepsy, CCF and COPD. Willagee qualifies as a hotspot for the same conditions with the exception of COPD; instead qualifying for CCF.

COPD is the condition with the most hotspots in the South Metropolitan area with 7. These are located in Armadale, Belmont – Victoria park, Kwinana, Rockingham and Mandurah. The next most prevalent hotspot condition is convulsions and epilepsy, with 5 hotspots. These occur in Armadale, Belmont – Victoria Park and Kwinana, but also in Fremantle – South and Willagee in Melville.

By far the greatest need in terms of PPHs occurs in country WA, particularly in the Kimberley as highlighted in the final map of this report.

Acknowledgement of limitations

The authors of this report would like to acknowledge the limitations of the data presented here. Confidence intervals were not provided against the SRRs. However, it is noted that 82% of the hotspots had SRRs that were statistically significant from the age-standardised rate for the state at the 0.05 significance level. Further, SRRs were calculated by taking aggregations of 3 years of hospitalisations and rolling forward one year at a time, for four years. Thus, on average, two thirds of the hospitalisations for one time period would be included in the next, transferring some of the excess utilisation and increasing the likelihood of persistence. Aggregation was necessary due to sparse numbers of admissions in some SA2s. Aggregation was further considered optimal given the effect of smoothing it provides in reducing the random variation found in annual rates.

References

1. Duckett S. Perils of place: identifying hotspots of health inequalities: Grattan Institute; 2016.
2. Epidemiology Branch; Department of Health Western Australia, 2017.
3. Muenchberger H; Kendall E. Determinants of avoidable hospitalization in chronic disease: Development of a predictor matrix: Centre for National Research on Disability and Rehabilitation, Griffith Institute of Health and Medical Research, Griffith University; 2014.
4. Martin CM; Sturmberg JP. General practice-chaos, complexity and innovation. Medical Journal of Australia 2005.
5. Harris MF; Zwar NA. Care of patients with chronic disease: the challenge for general practice. Medical Journal of Australia 2007.
6. Australian Government; Australian Institute of Health and Welfare. National Healthcare Agreement: PI 18-Selected potentially preventable hospitalisations. (online) 2015 (cited. Available from: http://meteor.aihw.gov.au/content/index.phtml/itemId/559032.
7. Australian Government; Australian Institute of Health and Welfare. Definition of Age-standardised rate from. Metadata Online Registry; 2005.
8. Australian Government; Australian Institute of Health and Welfare. Definition of Separation. Metadata Online Registry; 2005.
9. Australian Government; Australian Institute of Health and Welfare. Definition of Address—statistical area, level 2 (SA2) code (ASGS 2011) N(9). Metadata Online Registry; 2005.
10. Australian Government; Australian Institute of Health and Welfare. Definition of Remoteness classification (ASGS-RA) N. Metadata Online Registry; 2013.
11. Australian Government; Australian Institute of Health and Welfare. Definition of Socio-Economic Indexes for Areas (SEIFA) (2011 Census, ASGS 2011) cluster. Metadata Online Registry; 2014.
12. Australian Bureau of Statistics. Socio-Economic Indexes for Areas (SEIFA); 2011.

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